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Dedicated to the Science, Techniques and Applications Pertaining to the Photography of All Things Which Live or Which Have Lived

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Journal of the Biological Photographic Association Vol. 29, No. 1 February, 1961

Some Aspects of Photography of the Hand

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ACCURATE photographic reproduction of the hand is vitally important to the surgeon undertaking operative procedures. Size, shape, texture and color variations as well as deformities and function may all be accurately recorded before, during and after treatment. These, together with the judicious use of operative photographs, will preserve for all time interesting, unusual or teaching cases.

Photography of the hand may be simple or complex because of the many possible combinations of normal structure and function, together with abnormal conditions superimposed. One or both hands are often photographed in several views; complementary regional photographs may be necessary, e.g., fingernails. To achieve uniformly good results, standard positions, lighting, and photographic techniques are necessary. The medical photographic studio is the ideal place to carry out such procedures; when necessary, photography of the hand is done in wards, clinics, or in the surgical operating theatre.

Camera, Lens, Film and Filter

The camera size and type will be influenced by availability, personal preference of the photographer, and the intended use of the reproduction. Reflex type ground glass cameras give an exact preview of the area to be photographed; larger size cameras permit the use of a variety of film types; miniature cameras are well adapted to rapid sequence photography and are often used in the operating room.

The camera distance is influenced by the area photographed and the lens focal length. For photography of the

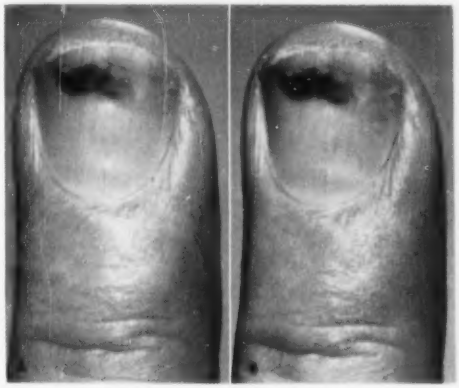

Figure 1. Oncolysis
A — Panchromatic film
B — Orthochromatic film. Increased contrast of skin texture and darkening of red subungual hemorrhage using orthochromatic film.

hand, the normal lens is usually used. Occasionally telephoto lenses will be an advantage to preserve perspective and to increase the working distance from camera to subject. The increased working distance allows the surgeon operative freedom, thus eliminating prolonged surgical procedures. For macrophotography of the skin and nails, short focal length lenses permit greater magnification with reasonable bellows extension.

Because of the usual pink flesh color of the hand orthochromatic film or panchromatic film with green filter will improve the hand texture and contrast. The exception is photography of dark skinned patients and photography in the operating room, where panchromatic film should be used to reproduce the red colors in a lighter tone.

Hand Support

In the studio it is convenient to support the hand on a sheet of glass large enough to accommodate both hands. A simple arrangement consists of an elevated glass with open sides, the bottom serving for backgrounds. The shadowless box usually used to photograph gross specimens is suitable. Alternately, the hands may be placed against an opaque background or photographed in mid-air. Such methods may cause undesirable shadows or movement, but these may be minimized by using flash lighting or ringlight illumination.

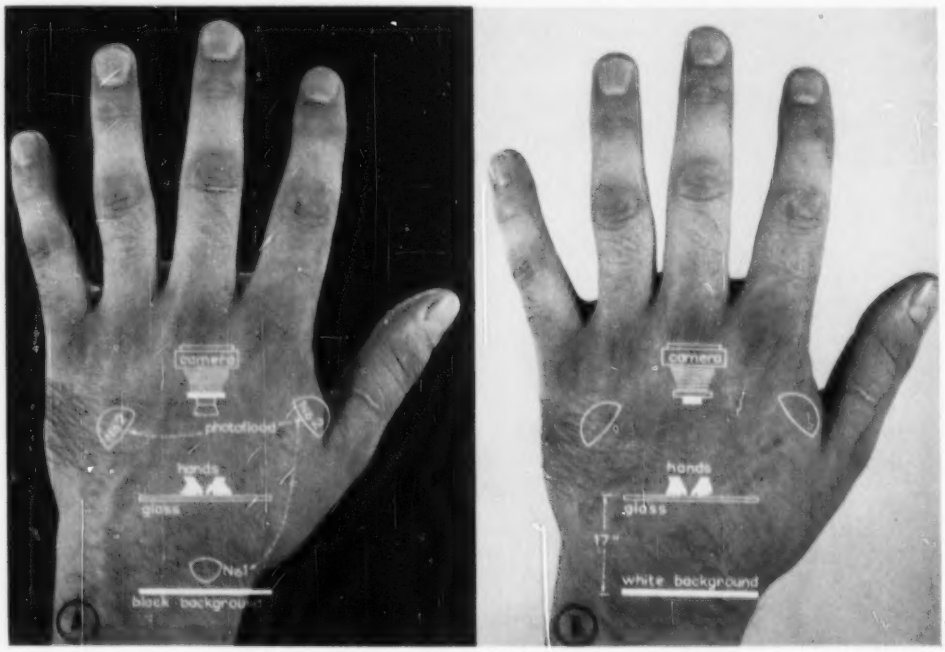

Figure 2. A — Black background with oblique transillumination. This technique gives sharp outlines, mainly in the web spaces and finger tips.

B — Shadowless background with hand supported on a glass plate elevated from the background. This technique is simple for accurate hand photography.

Lighting

The hand can be successfully photographed with continuous light or flash illumination. Photoflood lighting is suitable for co-operative patients. Flash illumination is preferable for use with those who do not co-operate as well as for photography in the operating theatre. Electronic flash illumination is an ideal light source for macrophotography of the skin and nails.

Standard lighting for one or both hands consists of two light heads about twenty inches from the hand at a 45 degree angle from the axis of the camera lens. This is suitable both for photography in color and monochrome. With a black background, an additional oblique light from below the hand will give the hand sharp outlines. For macrophotography one light source close to the camera lens is sufficient. A number of light sources should be avoided because problems arise when follow-up photographs are requested.

Background

The background should be evenly illuminated. It will be plain unless lines, grid screens or rulers are included to show relative size. With monochrome, white or grey backgrounds are usually used because they are easy to duplicate and give good background-subject separation. A black background is attractive and gives good separation. Oblique or semi-transillumination is necessary to give it sharp outlines. Complementary blue-green backgrounds give pleasing results when used with color film, although any neutral color is satisfactory. To avoid shadows, the part to be photographed should be placed on a sheet of glass

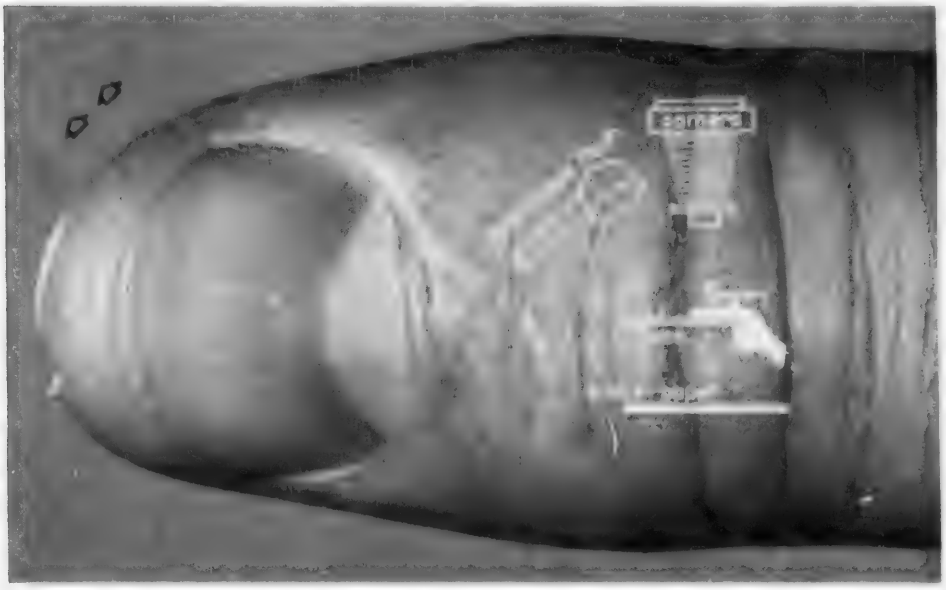

Figure 3. Macrophotograph of a normal finger. Arrows point to fingerprint on glass support.

Figure 4 Three methods of depicting size.
A Acromegalic hand beside normal hand.
B Acromegalic hand photographed with a scale.
C Same hand photographed against a grid.

elevated from the background. It is important that the glass be free of fingerprints or other extraneous markings.

To record size, scales may be placed on the glass or propped to the top surface of the hand. Alternately the hand may be photographed against a background of uniform lines or a grid screen. For a dramatic teaching demonstration, a diseased hand may be photographed beside a normal hand. Depth of field should be great enough to give overall sharp definition; this is attained by stopping the lens diaphragm to F:11 or F:16.

Hand Positions

Basic hand positions should be used for consistent duplication. Usual photographs include those of the extended hand viewed from the flexor and extensor surfaces, together with lateral views in flexion and extension. In pathological states, unusual views are necessary. Here excellent liaison between the surgeon and the medical photographer is essential. Function may be demonstrated by double exposures, serial photographs or by photographing with the hand performing an act, e.g., holding a pencil.

Because of the complexities of the hand and the many pathological states to which it is subjected, accurate photographic reproduction is difficult. Treatment is often prolonged, and written descriptions difficult to interpret. It is essential to the surgeon and ultimately the patient that photographs of the hand be consistently of good quality.

THE CHICAGO CHAPTER
cordially invites you and your family to attend the
31st Annual Meeting
of the
BIOLOGICAL PHOTOGRAPHIC ASSOCIATION, INC.
to be held at the
PICK CONGRESS HOTEL
August 21, 22, 23, 24, 1961
DOROTHY PENEHAM
Director of Communications
Chicago Chapter

First International Congress of Medical Photography and Cinematography

The First International Congress of Medical Photography and Cinematography was held in Dusseldorf, West Germany, September 27-30, 1960. Approximately 800 persons from 30 countries were registered at the meetings. The congress was organized by the Deutsche Gesellschaft Für Photographie E.V. It was a project that required a great deal of preliminary work and the fact that it was successful is tribute to the many persons who gave much of their time and energy.

The meetings were held in a group of buildings on the Ehrenhof exhibition grounds. In the Robert Schumann Saal there were 139 papers presented. These were translated into German, French and English. Simultaneously in the Europa Saal there were 121 papers presented. Nearly all of these were in German. At the same time 81 motion picture films were shown in the Kleiner Kongressaal. This building also housed the exhibits consisting of hundreds of prints and transparencies. The meetings started at 9 A.M. each day and continued until after 6 P.M. with a scheduled 2 hour interval between 1 and 3 P.M. This very full program with simultaneous activity in three separate buildings gave very little time for relaxation and made it necessary to study the program very carefully if one wished to attend a specific presentation. In addition to the banquet there were committee meetings and tours to places of interest. One day was spent at the Photokina in Cologne.

In spite of the fact that there were so many papers and films dealing with various applications of photography and cinematography in medicine there was no startling new revelation. However it provided a good opportunity to evaluate work done in various countries and to meet persons from those countries. The congress was considered to be a success and a committee was formed to continue planning for the next congress which probably will be held in England in 3 or 4 years.

A number of members from the Biological Photographic Association attended the congress from the United States. More detailed information about them has been reported to the Association News Letter which is sent to all members.

LEONARD A. JULIN

Journal of the Biological Photographic Association Vol. 29, No. 1 February, 1961

A Simplified Method of Recording Agar Diffusion Plates

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LESS than a decade ago one could count on either hand the number of individuals in this country and abroad who were engaged in the frustrating problem of photographically recording agar diffusion precipitin plates. Today, there are few medical photographers who have not had first hand experience with diffusion plates or who have not been exposed to literature describing various techniques employed for such recordings. The Journal of the Biological Photographic Association, alone, has disseminated four such articles in the past three years[1,2,3,4].

One technique, however, seems to have been overlooked or ignored, probably because it does not involve the use of a camera for recording. This is both understandable and excusable in view of the fact that we, as photographers, tend to turn first to the camera for assistance with most assignments. For want of a better word we shall call this the "shadow-graph" technique, one that has been utilized for quite some time and with considerable success at Dearborn V.A. Hospital in cooperative effort with the late Morris W. Wilson, M.D., in his experimental studies of the agar-plate precipitin test of Ouchterlony[5,6,7,8].

The problems presented by the agar plate and its lines of precipitation will be mentioned only briefly. The lack of precipitate-gel contrast; the transformation of the gel appearance under oblique illumination; the number and appearance of precipitate lines; the inherent artifacts in both plates and gel; the irritating reflections due to gel thickness and basin configuration; all are readily apparent the moment one holds such a plate in hand under gross observation. Those steps taken to overcome the outstanding faults common to most plates will be mentioned in the order in which they present themselves in the "shadow-graph" method of recording.

The first and foremost fault is that of the agar plate or Petri dish itself. They are not manufactured with the photographer and his problems in mind. Therefore, if you intend to record thousands of these plates, as was our intent, it is necessary to secure or to produce a plate with a glass bottom of good optical quality. Our plates were constructed of plexiglass rims and tight-fitting plexiglass covers and plane-parallel glass bottoms of photographic quality and tolerable thickness[9] (Figure 1). This item is not absolutely necessary to the "shadow-graph" technique of recording. It will, however, improve the ultimate result of any agar plate

Figure 1.

recording regardless of the type of illumination employed.

Figure 2 illustrates the set-up used in the "shadow-graph" technique. It is extremely simple, easily achieved, relatively inexpensive, and requires no equipment outlay other than a photo enlarger. And, neither the method nor its result will vary from one day to the next. Some sort of standardized illumination is established to insure that the amount and quality of illumination falling on the easel is constant; plate after plate, day after day. That portion of the easel upon which the lantern slide plate will rest is exactly centered with respect to the rectangle of light projected by the enlarger lens and the negative plane of the enlarger is focused on the easel. Once this is accomplished, the negative carrier is completely removed and set aside and all light falling on the easel other than that area to be occupied by the lantern slide plate is masked off by means of the enlarger's built in masking device.

The outside bottom of the agar plate is then vigorously wiped with alcohol dampened gauze to rid the surface of finger prints and other accumulated artifacts and the basins within the gel are flooded with a .001% solution of Orange G. Just enough to overflow the basins and completely cover the surface of the gel with a thin layer of liquid. Most air-borne particles of dust and lint, having settled previously on the gel surface, will become buoyant and may easily be removed from the surface of the liquid with a twisted length of lens tissue.

The Kodak Anti-abrasion Contrast Lantern Slide Plate (3¼ x 4) is placed on the easel and a strip of paper ¼ inch wide by 4 inches long and not more than .020 inches thick is placed on top of and along the short dimension edges of the lantern slide plate. This prevents the formation of Newtons Rings which would ordinarily occur if the agar plate were placed in direct contact with the lantern slide plate.

The agar plate is then centered over the lantern slide plate and in contact with the paper shims. It is best to take pains with such centering so that the lantern slide may later be masked and bound for direct auditorium projection. Exposure will depend upon the enlarger and the standard of illumination established, being 3 seconds at f16 in our particular case. The lantern slide plate is developed 3 minutes in Dektol (1:2) at 68 degrees F and when processed and dried serves as a negative from which projection prints of x3 magnification are made by conventional means. . .

Those who may be satisfied with a single 1:1 recording of agar diffusion plates may prefer to substitute projection paper for the lantern slide plate. If so, the use of the paper shim may be disregarded. Most immunologists, however, desire multiple recordings of the same plate and studies and measure-

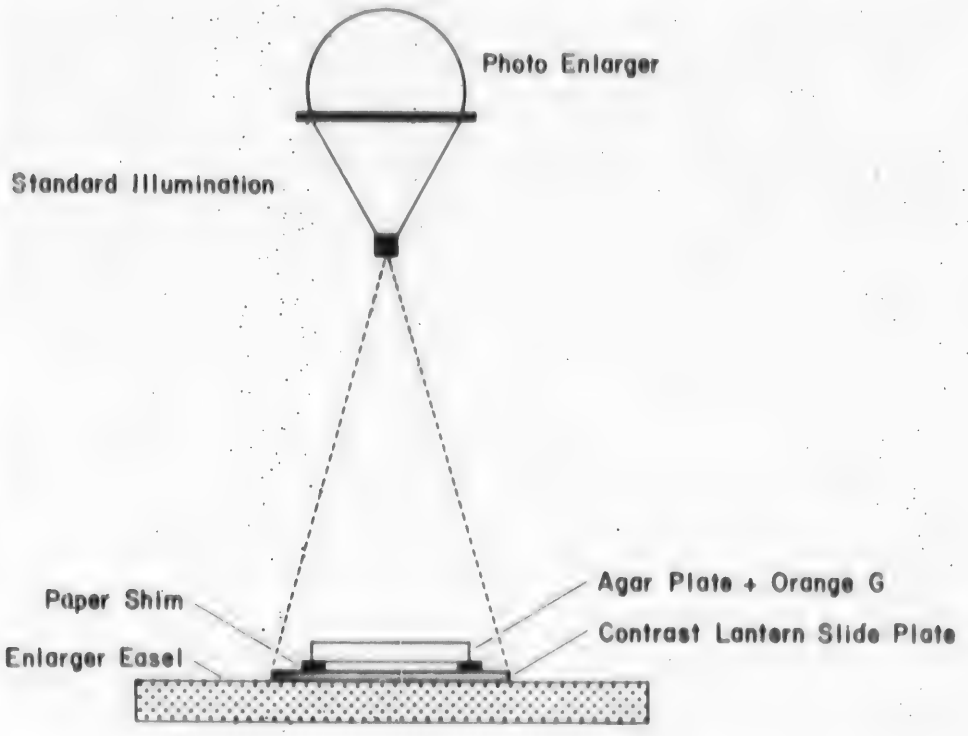

Figure 2

ments are more easily made from enlarged recordings. The anti-abrasion plate is easy to work with under a safelight, withstands considerable abuse, processes quickly and by inspection, is capable of unlimited enlargement, and, as mentioned previously, may be directly mounted and projected.

The use of Orange G offers advantages other than that already stated. It does away with the distracting patterns produced by the thickness of the gel around the edges of the basins; it keeps the surface of the gel from drying unevenly, thereby exhibiting further artifacts; and, it acts somewhat as a safelight to the emulsion of the lantern slide plate thereby permitting a more practical exposure time to be used. A .006% solution of Orange G is also incorporated in the agar itself at the time it is prepared and poured, thereby increasing contrast of the lines formed to a considerable extent.

The "shadow-graph" technique also offers an advantage in that it eliminates the possibility of the "butterfly effect" often encountered when a camera and oblique transillumination is employed in conjunction with a gel depth of around 5mm. An oblique ray of light when passing through anything other than a very thin (1mm) layer of gel will cause a fine precipitate line to appear heavier than it actually is and, in many instances, may obscure other faint and thin lines adjacent to it.

The resultant precipitate-gel contrast and the ability to record numerous fine lines when employing the "shadow-

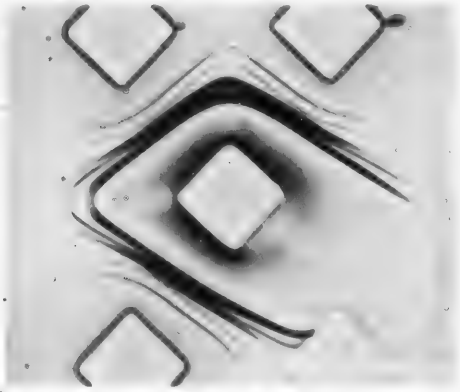

Figure 3a

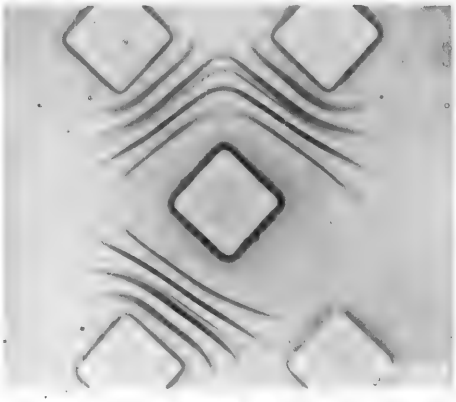

Figure 3b.

graph" technique is comparable to other methods using filters and more elaborate systems of illumination (Figure 3a and 3b). Also, the technique adapts itself fairly well to the various basin configurations now in use, including the column type plate (Figures 4 and 5). Furthermore, because of its sheer simplicity and because it does not require the use of a camera, it is no problem to train a laboratory technician or photographic assistant in its use, thereby freeing the photographer for more demanding duties.

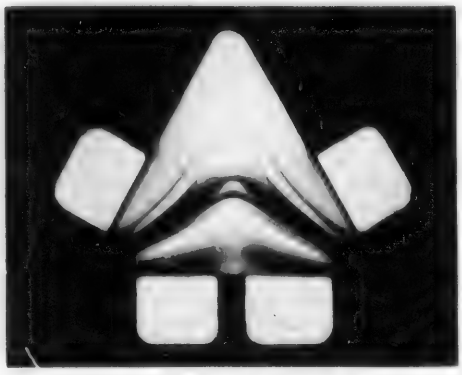

Figure 4.

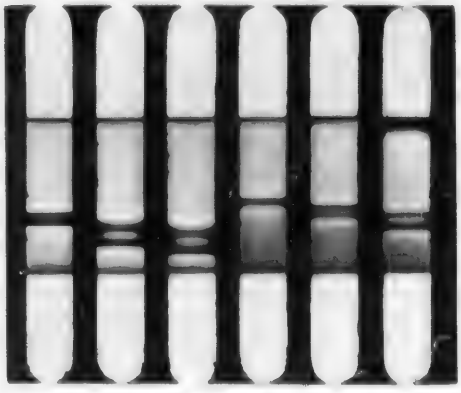

Figure 5.

BIBLIOGRAPHIC REFERENCES

1. Schutz, J. N.: Dark Field Illuminator for Petri Dish Photography. J. Biol. Phot. 26: 159-164, (No. 4) 1958.
2. Jackson, R.: Photographing Precipitin Bands in Agar Gel Plates. J. Biol. Phot. 27: 134-138, (No. 3) 1959.
3. Klontz, G. W., G. J. Ridgway, and G. P. Wilson: An Illuminator for Observing and Photographing Precipitin Reactions, in Agar. J. Biol. Phot. 28: 11-14, (No. 1) 1960.
4. Murchio, J. C.: Photography of Agar Gel Diffusion Microslides. J. Biol. Phot. 28: 65-68, (No. 2) 1960.
5. Wilson, M. W., and B. H. Pringle: Experimental Studies of the Agar Plate Precipitin Test of Ouchterlony. J. Immunology 73: 232-243, (No. 4) 1954.
6. Wilson, M. W., and B. H. Pringle: Interpretation of the Ouchterlony Precipitin Test. J. Immunology 75: 460-469, (No. 6) 1955.
7. Wilson, M. W., and B. H. Pringle: Cross-Reactions in the Ouchterlony Plate: Analysis of Native and Halogenated Bovine Serum Albumins. J. Immunology 77: 324-331, (No. 5) 1956.
8. Wilson, M. W.: The Agar Diffusion Precipitin Technique: A Comparison of the Simple and Double Diffusion Methods. J. Immunology 81: 317-330, (No. 4) 1958.

Journal of the Biological Photographic Association Vol. 29, No. 1 February, 1961

Experiences with Ektachrome ER Film In Open Heart Surgery

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IN the past few years medical and surgical research has increased with such rapidity that, from the time a hospital leaves the drawing board until it is fully equipped and ready for use it is frequently inadequate. From the first day of occupancy the cry is for more space, more space.

As our heart research program has grown and developed, and with a full time cardiac surgeon on the staff, as well as a thoracic surgeon on the clinical staff, we have been forced to change our set-up for this type of photography.

Prior to the advent of our full time cardiac surgeon we were able to use a homemade wooden stand and two B & M Junior spotlights equipped with explosion-proof switches. While far from ideal, this stand and lights had worked very well until we were requested to do routine movies of open heart operations.

When our operating room is now set up for heart surgery space is at a premium. There is the anesthetist with his equipment and accessories; the four channel polygraph with technician; an oscilloscope; the by-pass pump with two technicians; and in some instances an especially designed microscope for the observation of microcirculation in the eye. These various pieces of equipment, together with the Mayo table, instrument tables, and the necessary complement of nurses and assistants left no room for our camera stand and lights.

Since these operations are performed in a room with an observation balcony, we felt our only solution was to photograph through an open port. Consequently, a section of glass was removed and replaced with a sliding plexyglass panel that could be locked in place when not in use. A sliding platform was mounted on the sill and braced to the wall, and a Professional Jr. High Hat camera stand was mounted on the platform. To facilitate mounting the camera the platform is pulled back away from the port. When ready to photograph, the platform and camera are pushed forward with the lenses over the opening. In order to clear the operating room light-supports, it is necessary to move the table about six inches from the center.

To use this set-up with Type A Kodachrome would have necessitated that our lights still be on the operating room floor and in the way. Since our operating room lights are American Sterilizer "Video Lights", it was decided to try these with what was at that time desig-

Figure 1. Camera stand and lights used on operating room floor.

Figure 2. Mount for camera in observation balcony. When unlocked, top half of plexyglass slides down below platform.

nated as Type SO 270 film, since renamed Ektachrome ER Type B.

As many of you know, these lights are controlled from a wall switch with three positions — namely, Off, Medium and High. Burning the lights in the high position reduces the life of the bulb; but these are expendable, costing about $1.50 each. We felt that with the lights on high and placed where the surgeon could see, we could get adequate exposure.

With the camera in place (port open), a meter reading is taken from the camera position using an Elwood Exposure meter. This reading is checked each time the lights are moved and from time to time as the operation progresses more deeply into the chest. With this meter it is possible to get a reading, if necessary, down into the heart. The film clips we have made of heart surgery were all taken at an aperture of between f/5.6 and f/8. The camera used is the Maurer 16mm which has, among others, two features that we especially like. One, with the camera racked over into the focusing position and after the picture has been composed, a 140 diameter magnification can be introduced which insures exceptionally fine focusing. The other feature which we feel is extremely valuable, especially in available light photography, is the 235° shutter operat-

Figure 3. Camera in rear position. Meter reading being taken from open port from surface of the heart.

ing at 1/37 of a second at 24 frames per second.

There are occasions in this type of surgery when the operating room is darkened, a "Woods" light focused on the operating field, and Fluorescein injected into one of the vessels. The path the dye takes reveals quickly and surely if there are any hidden shunts present. We have long wanted to record this in color and to incorporate the footage in a teaching film. Working in experimental surgery in the past three weeks we succeeded in recording the luminescence of this dye as it was injected into the vessels of the mesentery of a dog. After seeing our results we returned to experimental surgery. Using three 100 watt type H black lights at from 12 to 18 inches from the operative field and a wild motor set for 8 frames per second, a shutter of approximately 1/12 second, and using a 2B filter on the lens, the vessel was injected. From the results obtained in this experiment we feel that we will now be able to record the path of the dye as it is injected into a vessel in heart surgery.

We have been so well pleased with the results obtained in the operating room with Ektachrome ERB film and low light levels that, since suggesting the title for this paper, we are changing over to this film for patient photography.

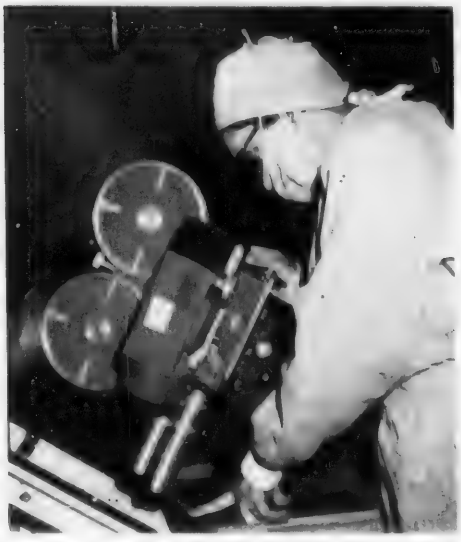

Figure 4. Camera moved forward into operating position and scene being filmed.

This permits the making of more adequate and longer record shots with much less discomfort to the patient.

In summary, we have attempted to show that where operating rooms are overcrowded excellent movies may be made with available light and Ektachrome ERB film from a position off the operting room floor. We have also mentioned the lessened discomfort to patients in patient pohtography brought about through lower levels of illumination, and we have shown one instance of tracing the path of an injection of a fluorescent dye.

In conclusion, we are very satisfied with Ektachrome ER film and feel that the results are excellent and equal to those obtained with slower films.

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Journal of the Biological Photographic Association Vol. 29, No. 1 February, 1961

Photogram Demonstration of Histological Specimens

JOHN R. WHITTIER, M.D., and PERCY W. BROOKS, F.B.P.A.

Creedmoor Institute for Psychobiologic Studies, Jamaica 27, New York and New York Hospital—Cornell Medical Center, New York 21, New York

IT is traditional to demonstrate localized experimental lesions in the brains of experimental animals by presentation of line drawings with contrasting areas to indicate site and extent (Fig. 1).

The method has several disadvantages, including laboriousness of the outlining and contrasting, the loss in detail respecting surrounding structures, the difficulties in adapting lesional areas to standard outlines of brain sections which are sometimes employed, and the inaccuracies inherent in manual copying from projected images.

The method described below as the photogram enlargement provides a negative photographic projection print made directly from the histological section without intermediate negative. The method is simple and inexpensive, and single and serial photographs of the site and extent of lesions in sections of brain are presently being obtained for comparative studies and publication illustration in a study on striatal deficit in the albino rat.

Method: Histological sections stained by the method of Weil and mounted in standard manner are held on the 35mm. negative carrier of a condenser enlarger by Scotch tape. The image is projected at a magnification of 12 times, permitting a full 8 x 10 inch print of the largest section. Contrast, usually good with sections so stained, may be increased by using a #5 contrast grade paper, developed in Dektol, mixed one part stock solution with one part water. It is convenient to identify each print

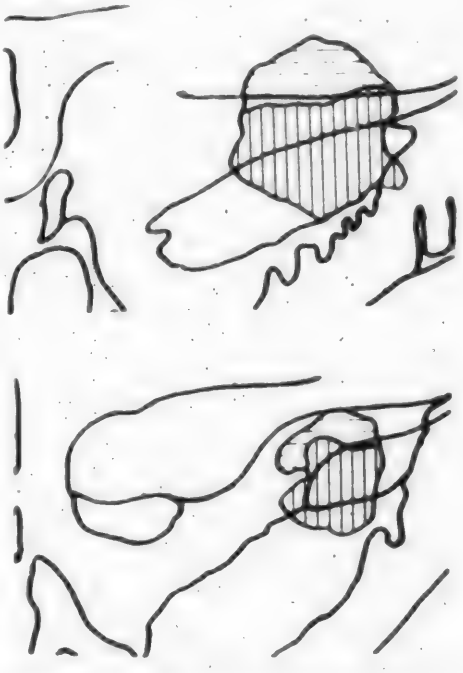

Figure 1. Outline drawing showing lesion in subthalmus of rhesus monkey. (Original in Journal of Comparative Neurology, *90*(3): 319-372, June 1949.)

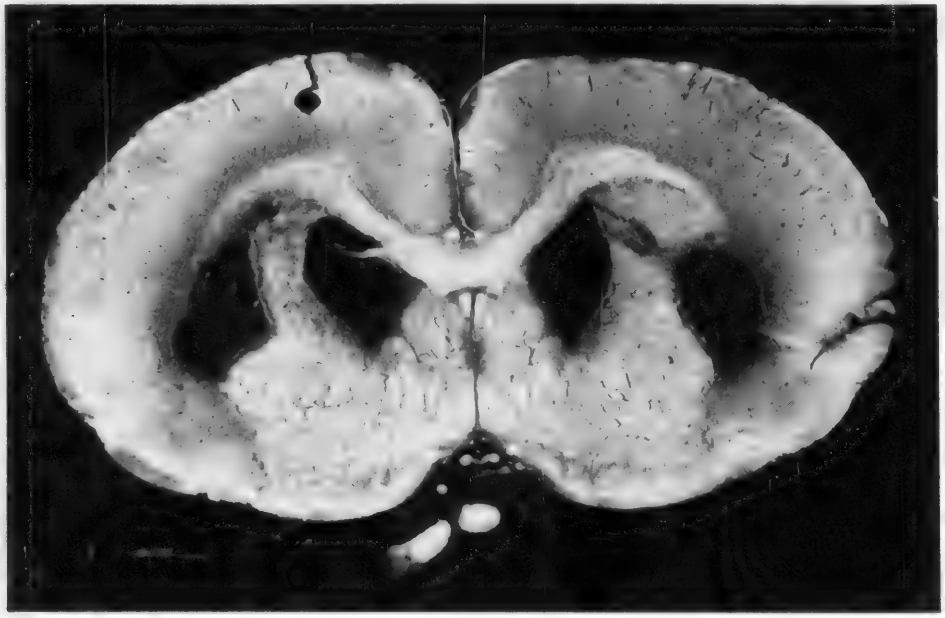

Figure 2. Section through the rostral part of cerebrum of albino rat, showing bilateral lesion in rostral third of lateral aspect of caudate nucleus. Stained by the method of Weil and processed by the method described in the text.

with the specimen and section numbers in pencil; alternatively, the slide may be marked, and the projection made of specimen and marking.

Figure 2 provides an example of a section so stained and processed.

Acknowledgement

This investigation was supported in part by a PHS Research Grant (M-3075) from NINDB, Public Health Service.

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Medical Photography in the United States*

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IN the United States as well as in other countries, members of the medical profession quickly recognized the intrinsic value of photography as soon as they learned of Daguerre's process. Due to the limitations of the process, its utilization was limited at first. However, with the improvement in photographic materials and processes, its use increased until eventually there were photographers who specialized in medical photography. At first they worked only in the larger medical institutions but today they are found also in many smaller hospitals and clinics.

It is difficult to estimate the number of medical photographers in the United States. There are 81 medical schools and all have some photographic service. Veterans Administration hospitals employ more than 150 photographers in addition to clerks. Estimates of the total number of persons earning their living in medical photography in the United States range from 800 to 2000.

Some medical photographers have acquired excellent training and experience in photography and can perform many facets of medical photography with great skill. Others know little about photography but do make a few photographs under standardized conditions. These persons may be medical or x-ray technicians, nurses, physicians and scientists who are working in medical institutions in addition to physicians in private practice who take photographs to meet their needs.

In the past 50 years several attempts have been made to establish schools of medical photography but they were discontinued after a few persons were trained. Many of the skilled medical photographers received their basic training in commercial photography. Others learned by serving an informal apprenticeship in established departments of medical photography.

Some departments of medical photography also include medical illustrators and persons who prepare exhibits. The size of a department devoted only to photography may vary from one person working part time to more than a dozen having full-time employment. Perhaps a description of the organization of the Section of Photography at the Mayo Clinic with which I have been associated for the past 33 years would be of interest.

At present at the clinic there are 15 employees in addition to the head of the section. Five of these persons are men who are rated as medical photog-

* Read at the First International Congress on Medical Photography and Cinematography, Düsseldorf, Germany, September 27 to 30, 1960.

raphers. Three men and two women are rated as medical photography technicians; one young man is a technician trainee; and four women are rated as photographic clerks. The photographers can handle any kind of camera work. The technicians do routine copying, make lantern slides, do some printing and other processing and are responsible for the maintenance of projection equipment. The clerks handle the incoming and outgoing orders, bind lantern slides, identify and trim prints and maintain the files of negatives. This department provides the photographic service for more than 800 doctors who are engaged in an intensive program of postgraduate education in addition to their usual clinical work. The administrative section also requires a considerable volume of nonmedical photography.

Working closely with this department is the Section of Medical Illustration which employs two artists and three draftsmen. In another section known as the Museum of Hygiene and Medicine, seven persons are employed who are concerned with the preparation and maintenance of exhibits. In many institutions these three departments are combined in one section.

Most departments of medical photography in the United States are provided with an annual budget which limits the amount of money that can be spent. If there is a surplus at the end of the year it usually is spent for new equipment. To balance this budget it is customary to make a charge for all photographic services. This may be only on the account books and without actually handling any money. In general, these charges are less than the charges made by commercial photographers. A few institutions do not have a limiting budget and do not make any charges for the photographic work; however, the volume of work is kept in restraint by certain controls. Some medical institutions have a photographic department but have a relatively small volume of work. In such instances the photographer may receive a small salary but he is permitted to use the same facilities to carry on personal work to supplement his income. However, most places have restrictions on such personal work.

The salaries paid to workers in medical photography in the United States vary a great deal depending on the worker's ability and on the institution that hires him. There is no standard wage scale such as that for photoengravers. Medical photographers employed in government hospitals are paid in accordance with the salary scale used for civil-service employees. Medical photographers employed in nongovernment institutions may receive higher salaries. In addition to his salary the medical photographer may receive other forms of remuneration such as free medical care for himself and his dependents, health and life insurance benefits and desirable retirement benefits. Intangible benefits also are derived, such as the pleasure gained from his work, his associates, and his surroundings. Americans sometimes are criticized for being worshippers of the dollar and in some instances this is true; however, there are countless numbers of Americans who have higher ideals than this and who consider high salaries to be of less importance than the intangible benefits and the opportunity to be of service. Prominent in this category are the workers in religious and educational fields. Likewise I believe that most medical photographers and workers in research laboratories have similar en-

thusiasms and their salaries, too, are quite comparable in many instances.

Prior to World War II it was rather common for a department of medical photography to be located in the most undesirable place in an institution. During the war years the use of audio-visual aids became so important that in recent years many photographic departments have been provided with new and more desirable quarters thus gaining in prestige. The prestige of the medical photographer varies with the individual and with the institution where he is employed. In many places he is highly regarded and is given the same accord as members of the professional staff but, regretfully, in some instances this is not true.

In larger institutions the department of medical photography usually is an independent department with the chief photographer directly in charge but answerable to the hospital administrator or to a committee of staff physicians. In some smaller institutions the photographer may be part of a department of pathology or radiology. In recent years there have been increasing amounts of money provided by various grants for use in medical research. These grants have thus increased the demand for photographic records; have provided for the purchase of photographic equipment, and have increased the demand for medical photographers.

No doubt the duties of the medical photographer in the United States are similar to those in other countries. There may be some differences in the equipment that is used, but the problems and results are comparable. Likewise the utilization of medical photographs may be similar although the volume may differ for obvious reasons.

Today there are many more medical photographers in the United States than there were 30 years ago. Those who were in that profession then were not organized and some who worked in remote areas did not know another medical photographer. Because of the large size of the United States it was possible for two medical photographers to be separated by a distance as great as the distance between Düsseldorf and Nigeria. Most medical photographers in those days were in the eastern part of the United States. In 1931 they were invited by Mr. Ralph P. Creer, then at Yale University, to meet with him to form an organization. Twenty-eight persons attended this meeting which was the beginning of the Biological Photographic Association. A number of medical photographers in other parts of the country joined immediately to qualify as charter members. A quarterly journal was started and since 1931 yearly meetings have been held. The organization continued to grow in spite of financial difficulties due to an economic depression that lasted for several years.

Some of the immediate benefits from organizing were the valuable exchange of ideas, the growing friendship with fellow craftsmen, and the opportunity to see samples of workmanship of other photographers in exhibits of prints, transparencies, and motion pictures. Another important accomplishment of group action was to persuade the manufacturers of photographic equipment and sensitized goods to provide items to meet the specific needs of the medical photographer. The individual members gained prestige not only because they were members but also because of publicity they received when appearing

on programs or when receiving awards at annual meetings.

The members undertook a number of projects one of which was the compilation of detailed information about each of the members which was given to the United States War Department. During World War II many members joined Army units of medical photographers that were organized under the direction of Mr. Ralph P. Creer, a commissioned officer. During this time some progress was made in establishing classifications and ratings for medical photographers. After the war these units were discontinued but similar units were established in the government hospitals operated by the Veterans Administration. These units were under the direction of Mr. C. Graham Eddy, who devoted a great deal of time to the problem of classifications and ratings. The result was a descriptive analysis of the duties of a medical photographer and a guide for evaluating his photographic proficiency. This study of these problems has provided a basis for salary ratings and the information has been of value not only to medical photographers in government hospitals but also to those employed elsewhere.

The photographers in the veterans' hospitals in the United States have had a great stimulating effect on medical photography locally as well as nationally. This enthusiastic group of well-trained craftsmen has been highly valuable to the Biological Photographic Association through its participation in association affairs and exhibits.

Through the years the Biological Photographic Association has continued to increase in size and activities. While its early membership was concentrated in the eastern part of the United States, it now has a large proportion of its members in the central and western parts of the country. The total membership at present is approximately 800 persons. Members in various sections of the country have organized local chapters and conduct local meetings. Some chapters have co-operated and hold regional meetings in addition to the annual meetings conducted by the national organization. The national organization provides a number of awards, the highest of which is the Louis Schmidt Award, which usually is given annually for outstanding contributions to the progress of biological and medical photography. The award consists of a diamond-studded BPA gold key and a special certificate. An Award of Merit in the form of a certificate is presented annually for the best paper that is published in the journal. Award of Merit certificates are presented each year for five categories of photographic entries in the salon. Each recipient of these five awards also receives $25.00 in cash which is supported by a grant from the journal of one of the leading medical societies. The association receives some financial aid from sustaining members, but it is independent and not affiliated with any other organization.

The Biological Photographic Association has helped the individual photographer to gain justly earned recognition by providing Fellowship awards. To be eligible for a Fellowship, a candidate must have been a member of the association for 5 consecutive years and must possess or have achieved one or more of the following qualifications: (1) superior craftsmanship in still or motion-picture photography of biological subjects, (2) ability in photographic research in new methods or materials,

and (3) meritorious contributions to others he finds it necessary to be well biological photography through sustained organization work. This award also is in the form of a certificate.

The American Medical Association has recognized the value of good medical photography and since 1957 has given two awards each year for the photography appearing in scientific exhibits at its annual meetings. These awards are certificates suitable for framing. The resulting publicity also adds to the prestige of the photographer.

In conclusion, the medical photographer in the United States is an intelligent, serious, dedicated craftsman who is eager to do the good job that is expected of him. In some places the variety of his work is limited, but in acquainted with the many facets of medical photography that are being presented on the program of this congress. At present the Biological Photographic Association is working on the preparation of standards for classification of medical photographers. When these have been accepted it will be possible to present a more statistical review of the status of medical photographers in the United States but up to this time it has been necessary to speak only in general terms. However, our craftsmen welcome this opportunity for the advancement of knowledge and the exchange of ideas made possible by the First International Congress of Medical Photography and Cinematography.

GAINS REPORTED BY FILM LIBRARY

An 85% increase in use by medical societies of its films was reported for 1960 by AMA's Film Library. During the year 282 medical societies used 479 films from the library, compared to 151 societies using 258 films in 1959.

The Film Library reported 7,570 bookings in 1960, an increase of 34½% over 1959. The 7,570 bookings for 1960 compares with 1,572 bookings in 1951. During the 10-year period ending in 1960, the Film Library has completed 37,693 bookings.

The library now contains 1,066 prints of 254 subjects, reported Ralph Creer, director of AMA's Department of Medical Motion Pictures and Television. There are 725 prints of 172 medical subjects for professional audiences and 341 prints of 82 health films for lay audiences.

Civilian hospitals are the largest users of AMA's films, with 2,307 films lent to hospitals in 1960, compared to 1,499 in 1959, an increase of 54%.

Eighty-three medical schools used 975 films last year, a 7% increase over 1959. Creer said that 96% of the medical schools in the U.S. borrowed films in 1960.

Biological Phenomena Revealed in "Living Biology" Film Preview

First of Yeshiva U.'S Educational Films

Presented by

DR. ROMAN VISHNIAC

The first heart beats of a living organism . . . the conveyor belt the oyster uses to feed itself . . . the 42 baby-blue eyes of the scallop . . . blood circulation in microscopic and small sea life . . . and other biological phenomena were revealed on film for the first time here yesterday (Tuesday, Dec. 13) at a preview showing of Yeshiva University's "Living Biology" experimental film series.

Dr. Roman Vishniac, Russian-born research biologist and one of the world's foremost photographers of microscopic life, showed the initial film in his series which will enhance biology instruction in high schools and colleges across the nation. The film entitled "The Living Tide" is the forerunner of thirteen 16 mm. sound-color films Dr. Vishniac is producing under an 18-month $112,340 grant from the National Science Foundation to Yeshiva University. Dr. Vishniac will also exhibit the preliminary version of the film (unsounded and unedited) to the National Association of Biology Teachers at the American Association for the Advancement of Science convention in the Roosevelt Hotel, New York City, on December 29.

"These films," according to Dr. Vishniac, "are designed to stimulate interest in biology. You cannot teach biology, the science of living things, with a bottle containing dead organisms. And you cannot get the real picture of the way animals or organisms behave by filming them in an aquarium."

What Dr. Vishniac has done and will do throughout the entire series which will eventually include 40 films, is to photograph all his subjects under completely natural conditions. The animals and organisms are not imprisoned; are not mounted or handled in any way. They are observed through the discerning eye of this master photographer as they live, where they live.

Plants That Move Like Animals

In addition to the "Living Tide," Dr. Vishniac showed additional material which will be incorporated in later films. Highlight of this was a sequence showing plants that move like animals.

Dr. Vishniac showed a species of diatone which moves in the water in a manner similar to certain microscopic animals. The juxtaposition of the two sequences, showing movements by the microscopic plants and animals, provided an exciting climax to the one hour film presentation.

The grant for the production of the "Living Biology" Film Series was announced last August by Dr. Samuel Belkin, President of Yeshiva University. It covers production of eight films of 28 minutes each for high school use and five for 45 minutes each for college and university use. All will be 16 mm. sound-color films.

Dr. Vishniac plans to produce a total of 24 high school and 16 higher education films in a three-year period.

Cooperating With Biology Teachers

"Since these films are designed not to replace biology teachers but to assist them," Dr. Vrshniac commented, "I am working in close cooperation with leading biologists in universities throughout the country as well as with members of the National Association of Biology Teachers.

"Although I have made many biology films before, I have always looked forward to this opportunity to work together with leading scientists to help in the education of our young people.

"Biology is the gateway to all sciences. Therefore it is important that our youth study it and that they learn it in the best possible way. We cannot use substitutes for the biology teacher. But we must inspire our students to want to find out more about biology and we must show them what we tell them about in lectures and textbooks.

"Until now this has not been possible. Previous biology films would show a teacher lecturing and would use models, charts or microscopic views of dead organisms. I don't believe that this is the correct filming approach. I don't believe you can replace the teacher. But I do believe that we must excite and interest the student and we must let him see life among all living things as it really is.

Series to Cover Nine Major Areas

The "Living Biology" film series will cover nine major areas: Units of Life (protoplasm and cells); Structure and Function of Organism (organs, systems, etc.); Growth and Development (embryology); Origin of Life (evolution); Heredity (genetics); Structure and Function of Nature (ecology); the Plant World; the Animal World; and the Microbial World.

All filming will be done in those geographical areas which are the natural habitats of the living organisms to be studied. Among the locations expected to be used are Jamaica, B.W.I.; Woods Hole, Mass.; the Scripps Institute, La Jolla, Calif.; Friday Harbor, Wash.; the Aquarium of Miami University, Coral Gables, Fla.; Fish and Wild Life Marine Laboratory, Maine; and the Marine Laboratory, Bermuda.

Dr. Vishniac's pioneering work in cinematography involves the use of transmitted oblique and semivertical illumination which in his experience produces results superior to those of conventional—direct or phase—contrast of the internal details of organisms. He uses immersion lenses whenever possible in preference to conventional flat mounts between slide and cover slip in order to permit the organisms to move normally and to emphasize the third dimension. This approach and method reveals organisms in a completely relaxed state within their natural environment. It also preserves natural colors that are usually destroyed in conventional microscopy by transmitted light, reflections and glare.

Dr. Vishniac was born on Aug. 19, 1897 near St. Petersburg, Russia. He holds the Ph.D. degree in zoology from Shanyavsky University, Moscow. Dr. Vishniac did research in endocrinology and also held the M.D. degree from Moscow University. He fled Russia in 1920, via Latvia, and lived for 19 years in Berlin, Germany.

While in Berlin he did post-graduate work in Oriental art at the University of Berlin, completing work necessary for a Ph.D. Also while in Berlin he continued his biological research, made a study of optics and the behavior of light, and worked as a portrait and journalistic photographer.

In the late 1930's, portents of the approaching Nazi regime, sent Dr. Vishniac on a series of expeditions to photograph the faces and lives of Jews in Eastern Europe. A selection of these pictures, published under the title "Polish Jews," has been widely hailed.

Dr. Vishniac came to the United States in December, 1940. After devoting time to a career as a still photographer, he was able to apply his talents to microscopy and scientific cinematography.

He has pioneered time lapse technique in cinematography since 1924. He is former president of the New York Entomological Society; fellow of the New York Academy of Sciences; fellow, Royal Microscopical Society (England), fellow of the Biological Photographic Association; and member of the American Society of Zoologists.

He received, in 1956, the Memorial Award of the American Society of Magazine Photographers for "showing mankind the beauty of the world it can not see." He also won the Grand Prize in Art in Photography at "Art in U. S. A., 1959."

Yeshiva University, America's oldest and largest university under Jewish auspices, consists of 17 schools and divisions located at six teaching centers in New York City. Five thousand young men and women are pursuing courses in Jewish studies and liberal arts and sciences, leading to undergraduate, graduate and professional degrees and diplomas.

The University's Main Center is located at Armsterdam Avenue and 286th Street, Manhattan.

Examination No. 6082, Supervisor of Medical Illustration and Photography.

On April 29, 1961, New York State is conducting an examination for Supervisor of Medical Illustration and Photography in the Roswell Park Memorial Institute, Buffalo, New York.

In order to take this examination, a candidate must have had two years experience in medical illustration plus three years experience in either photography, illustration or scientific research. Academic training in medical illustration or college study in the physical or biological sciences may be substituted for the three year general requirement on a year for year basis.

The New York State Department of Civil Service, Examinations Division, The State Campus, Albany 1, New York.

Journal of the Biological Photographic Association Vol. 29, No. 1 February, 1961

Maximum Print Size from Minimum Facilities — Photomurals and the Biophotographer

E. LYNN BALDWIN

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THE purpose of this paper is to acquaint the photographer with the making and mounting of mural size prints in a small studio with limited darkroom facilities.

There is nothing mysterious about making photomurals; they are made by the same methods used for making enlargements except that photomural printing and processing are on a larger scale.

The Negative

The primary consideration, as in any enlargement, is the negative. Only negatives that are critically sharp should be considered. Good enlargements up to 30" x 40" can be made directly from negatives as small as 35mm. Generally speaking, however, better results will be obtained with negatives of larger sizes, the largest negative your enlarger will accommodate.

If the negative is too small to produce the desired degree of enlargement with your projection system, it will be necessary to make an enlarged film positive. Retouching, if necessary, can be done on the new negative. Commercial film is generally suitable for both positive and negative, as it allows considerable control of contrast and print quality.

For projection the enlarger can be turned to project on the floor for a greater degree of enlargement. However, an enlarger that can be adjusted to project on the wall will be more satisfactory. In adjusting the enlarger for wall projection two things should be carefully considered. First, the plane of the negative carrier should be parallel with the wall. This can be checked by projecting the frame of the negative carrier and adjusting the enlarger till the two diagonals of the projected rectangle are the same length. Second, the illumination on the easel should be even. It is extremely difficult if not impossible to compensate for uneven illumination, especially when the strips in a large print must be matched perfectly.

The Paper

Photographic paper used in making photomurals is designed specifically for this purpose. It will withstand the stresses involved in handling large sheets during processing, washing and mounting.

Photographic paper for making murals is supplied in rolls of 30, 100, 250, and 500 feet in length and in 40 and 42 inch widths, single and double weight. Murals

that are to be spliced must be made with single weight paper.

Roll paper can be obtained in both bromide and chlorobromide emulsions, and in a limited number of surfaces. Eastman Kodak, Ansco, and Dupont have a variety to select from.

Each has a warm tone paper that can be toned. Kodak's product is known as "Mural R" and comes in grades 2 and 3. Dupont's is called "Warmtone", and Ansco's "Portrait Proof." The latter two come in a single contrast emulsion with wide exposure and development latitude.

Printing

Mural size prints that exceed the forty-two inch width of roll paper must be made in strips and spliced together in mounting. In planning the layout of the mural allow about 1½ to 2 inches overlap on each strip. Also if the length of the picture is critical or the picture is to be several strips in length, the amount of expansion of the printing paper when wet should be calculated. If this is not done, one may find that the picture is from several inches to a foot too long when ready for mounting. It is advisable to allow about ¼" to the foot for expansion.

Exposure time is computed in the same way as for any enlargement. Test strips should be made carefully throughout the length of the projection in order to obtain representative tests. It is important to use strips that are large enough to cover important areas. Remember that in making test strips for a mural in which two or more strips are to be spliced, the developing time as well as the exposure time must be calculated. Development time must be sufficient to allow the handling of large amounts of paper in the developer.

Processing

It is not practical in a small studio that does occasional work to stock trays larger than 16" x 20" much less trays 6 to 8 feet to accommodate large prints. A technique other than that used for processing conventional size prints must therefore be used.

This technique consists of using long narrow troughs with round bottoms, Figure 1. They are 12 to 15 inches in width, about 50 inches in length and approximately 6 inches deep. They can be placed on a rack one above the other or in any workable position when in use and can be nested and stored when not in use. However, if it is inadvisable to invest in a set of trays as described above, inexpensive substitutes can be easily made. The materials needed are: 2 pieces of two-by-four, thirty inches in length; four pieces one inch square wood strips fifty inches in length, and a piece of sheet plastic measuring approximately 72 by 48 inches. By nailing one 1" square piece to either end of the top of the two-by-four and spacing the other two equidistant apart, then tacking and draping the plastic over the frame will make three

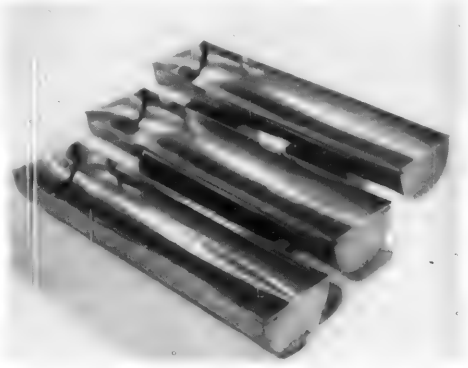

Figure 1. Stainless steel trays suitable for developing roll paper for photographs. These trays are 45" long, 10" in width and 6" deep.

trays, Figure 2. This makes quite a satisfactory arrangement for occasional use.

The procedure of developing long strips of paper with the previously described equipment is to roll the paper through the solution. The actual technique of rolling the paper can only be developed with practice. The development time begins when you start the paper into the developing solution and ends when taken out. As you will see it will take some time just to roll the paper into the solution. To develop it evenly it will have to be kept in motion by rolling and rerolling several times. This can easily give you a developing time of five to six minutes. This is considerably longer than the $1\frac{1}{2}$ to 2 minutes in conventional processing. This additional time should be taken into consideration when making test strips.

Each strip of the picture will have the same basic exposure time and developed exactly alike. In order to assure even development time throughout the strip of paper, the end that is rolled into the developer first should be the first end out and first into the stop and hypo solution. It is very important that the developer stay a constant temperature. Also the rate of exhaustion of the developing solution should be computed. The developing life of Dektol diluted 2-1 is 9600 square inches of paper. This is equivalent to a sheet of mural paper 42" x 19'. Thus if development of long strips is involved it is possible that fresh solution will have to be supplied for each strip developed. In this case one must be prepared with an adequate supply of processing solutions.

As in the case of development, most laboratories are not equipped for washing large sheets of photographic paper. However, this may be accomplished by flooding a darkroom sink. The rolls are placed in the water and frequently rerolled, thus exposing the entire surface to fresh wash water. The use of a hypo clearing agent will greatly reduce the washing time and insure the stability of the print. After thorough washing the prints may be wet mounted immediately or air dried. If facilities permit, prints can be dried on large muslin drying racks or looped over wooden bars. Otherwise they can be sponged off and laid out in a clean, dry area and allowed to dry. They can be laid out on newspapers on the studio floor if necessary.

Figure 2. Finished trays.

Toning

Before toning it is very important that photomurals be fixed and washed thoroughly for maximum permanence. Toning will give the print improved permanence. Precautions for toning murals are the same as in any other photographic toning. However it is recommended that only toner that tones to completion be

used. These include Kodak brown toner, Blue toner, and Sepia toner, or similar products.

Mounting

Photomurals can be mounted directly to plaster walls or wallboard. However, they cannot be mounted over old wallpaper. Also they can be mounted on plywood, masonite, Upsom Board and other types of composition board. These in turn can be mounted to walls or other supports. The method most useful to the biological photographer will probably be the latter.

Dry mounting is an excellent way of mounting small murals but is limited by the size of mounting presses and the difficulty in dry mounting large prints with a hand iron. Consequently, wet mounting is the most satisfactory method.

A smooth surfaced, water-resistant wall board is preferred for mounting. Masonite, Homosote, Upsom, or Plywood are satisfactory. Some workers recommend the use of muslin or photographic paper applied to the mount as a barrier layer to prevent chemical stains from the mount itself affecting the print over a period of time. However, over a period of ten years I have not found prints mounted directly to be adversely affected.

The equipment needed for mounting will be: wallpaper paste, a bucket and paddle for mixing, a wide paint brush (2" to 6"), for applying paste, a pail of lukewarm water, large viscous sponge and clean rags for rinsing and sponging print.

Photomurals can be mounted with either commercial grade clear gelatin or wallpaper paste. The paste method will be described in this paper. Steck O "C" paste, manufactured by the Clarke-Steck Corp., Rochester, N.Y., or any high grade wheat paste is satisfactory.

The mounting board should be supported on a large clean table. Prints are much easier to work on a flat horizontal surface. If the barrier method is not used the mounting board should be given a primer coating of thin paste and allowed to dry. Be sure the paste is mixed smoothly and without lumps. This is accomplished by adding the paste to the water (not the water in the paste).

The strips should now be timed and matched to allow for correct overlap. After the mounting board is dry a generous coat of paste of normal consistency should be applied. The mural which has been previously well soaked is ready to be applied. The first section of the print is then placed and smoothed down with a squeegee or sponge. Squeegeeing the mural at normal pressure will smooth the print and force out airbells as well as the excess paste. The next section can then be matched and squeegeed in the same manner, Figure 3.

In making prints of this type it is necessary to make the print larger than the mounting board by leaving from six to twelve inches of excess paper at the

Figure 3. A. each seam the prints are matched.

top and bottom depending on the size of the mural. Also allowance should be made on the left hand side of the first strip and the right side of the last strip. This excess is overlapped onto the back and thus causes the mural to pull down tight as it shrinks when drying.

When all strips are in place the mural is then carefully turned face down on the mounting table. The excess paper from the front should now be pulled tight and pasted on the back. The corners should be mitred where the sides and ends overlap, Figure 4. After all the flaps have been pulled tight and pasted, give the entire back a coat of paste and apply strips of freshly wet heavy brown paper

Figure 4. With print face down mitre corners.

Figure 5. Business office of Northwestern Bell Telephone Co., Des Moines Iowa. Mural is 28" x 8", photograph and mural were made by author.

covering the entire back including the flaps from the front.

When photomurals are wet mounted, the photographic paper expands in the soaking process and contract upon drying. The force of the contraction in the drying can cause even strong mounting boards to warp. The heavy brown paper put on the reverse side tends to counteract the shrinking of the photographic paper, and also keep the edges from pulling loose.

The surface of the print should be sponged carefully to remove all excess paste. The print should be allowed to dry in a position to allow the front and back to dry at about the same rate. It can be dried flat on the floor if turned at frequent intervals to equalize drying.

After the print has been spotted and colored (if desired) both the front and the back should be given a coat of print lacquer to seal out moisture.

Prints mounted on walls can be nailed to a frame of one by two inch material. Thus setting them away from the wall and allowing for flow of air around the mount. This eliminates harm from wall dampness as might be found in basements and other weather exposed walls. The nail heads can then be spotted.

In summary, the biological photographer with limited facilities and with conventional photographic techniques can now make use of the impact of extra large pictures in exhibits, Figure 5, and many other applications as an added service to his Institution.

References

Making and Mounting Black and White Photomurals – Kodak Pamphlet No. C-12

Chemical Preparations – Kodak Data Book

WANTED: Medical Photographer who is experienced in all branches of medical photography is required for large teaching hospital. A new department of medical photography is being started. The successful candidate will be given every facility to organize and operate the department. Bachelor's degree preferred.

Address applications with references, qualifications and salary expected, to Dr. J. Gilbert Turner, Executive Director, Royal Victoria Hospital, Montreal 2, Canada.

Presentation of Louis E. Schmidt Award to Lou Gibson in the Office of the President of Eastman Kodak Co. February 21, 1961

As you all know, our own Lou Gibson was honored at Salt Lake with the Louis E. Schmidt Award.

Tradition decrees that the person so honored the previous year presents the award. Unfortunately, Dr. Paul Holinger, who was honored last year for his contributions to endoscopic photography, was in Europe and Lou could not be with us because of illness. Al Levin read the Citation at the Awards Banquet and from its reception the decision of the Committee was heartily endorsed by the membership.

Since that time the Committee has had difficulty in getting "presenter" and "presentee" together so the presentation could be made official. However, Mr. Vaughn, President of Eastman Kodak, was good enough to suggest that it be made in his office in Rochester, setting the 21st as a convenient date.

Unfortunately, Dr. Holinger was previously committed to appointments on the West Coast and asked Merv La Rue to substitute for him at Rochester.

Accordingly, the group met in Mr. Vaughn's office. Charlie Brownell introduced Merv to Mr. Vaughn and Merv explained that he was substituting for Dr. Holinger. He told the group in brief something about the Association in general and the Award in particular, how it got its name and that it was the highest honor the Association could bestow.

It was explained that the Award was really in three parts—a verbal Citation, a Certificate—and a diamond key. Merv then read the Citation which Lou had not previously heard.

> "The Louis E. Schmidt Award is the highest honor our Association has to bestow.
>
> "In the past, recipients of this award have usually been honored for contributions to some particular aspect of biological photography. This year we honor one whose activities and contributions range over a vast area of the photographic spectrum.
>
> "Leaving the University of Illinois in 1935 with a B.S. degree in engineering physics, he got a job—a job with a large industrial organization we all highly esteem. Since that time much of his work has been of direct benefit to our organization. His development of formulae for photomacrography—his work on simple and optimum lighting for photographing medical patients—his research in infra-red medical photography—the hours and days spent in-

structing in our annual workshops—is known and appreciated by all of us. His contributions to bio photography and to its literature are far too many to mention and we will leave that for his biographer.

"He has found time to write three books—two on medical photography and one on photography as an art. He has contributed chapters to, or edited many others. He served a term as editor of our Journal.

"He has served the Association in some official capacity for over 15 years culminating in his serving as its President in 1956 and 1957.

"He is a Fellow of the Photographic Society of America—of the Rochester Academy of Science—and of the Biological Photographic Association.

"But there is so much more—he is a warm personal friend to all of us.

"The Louis Schmidt Award for 1960 goes to our own Lou Gibson."

The Certificate and Key were then presented to Lou with the best wishes of us all.

SCHMIDT AWARD — At Kodak headquarters in Rochester, N.Y., Mervin W. La Rue, president-elect of the Biological Photographic Association, center, presents Schmidt Award of the BPA — pin and scroll — to H. Lou Gibson of Eastman Kodak Company for achievement in medical and scientific photography. From left, Charles G. Brownell of Kodak's x-ray sales division staff; Gibson with scroll; La Rue; William S. Vaughn, president of Eastman Kodak Co.; and Edward Rusin, assistant manager of Kodak's x-ray sales division.

MEDICAL AND BIOLOGICAL ILLUSTRATION

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OCTOBER, 1960

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Association News

A section of the Journal devoted to official announcements, chapter events, and other matters of historical significance to the Association.

PRESIDENT'S ADDRESS DELIVERED AT OPENING SESSION 30th ANNUAL MEETING, SALT LAKE CITY, UTAH

I am most happy to add my word of welcome to all of you at this Thirtieth Annual Meeting of the Biological Photographic Association. I would like to take a moment to acknowledge the months of preparation by the Intermountain Chapter who are our hosts here in Salt Lake City this year. General Chairman Howard Tribe and his committees have worked long and diligently in order to have everything in shape for this moment. Only those who have had the responsibilities and burdens of sponsoring an annual meeting have any realization of the tedium and strain involved. I express to you the sincere gratitude of those members present and indeed of those who are not able to attend but who will profit although less directly from this conference for your devotion and loyalty for your efforts in their behalf. We know that your only reward lies in the satisfactions of a job well done. We know that the pressures of seeing that everything goes smoothly will prevent you from attending many of the sessions which you labored so hard to perfect for these unselfish sacrifices we truly thank you.

This time had traditionally been set aside for the President to give an accounting of his stewardship, to speak for the Board and report the progress during the year just past and envision its aspirations and goals for the future. This is in no sense a complete report. I cannot squeeze into the few short minutes available this morning what took the Board almost ten hours yesterday and more than that last Spring to hear and discuss. It must suffice to touch briefly the most sensitive spots, sketch lightly key features in the overall picture.

We note with rather warm satisfaction the florid state of being enjoyed by the Chapters program. I have the privilege of announcing that another new chapter, the 19th in our official family, having fulfilled the requirements was granted its charter last evening.

This seems to be an encouraging sign. But a disturbingly insistent discordant fact is apparent. Relatively few of the individuals which make up the total Chapters membership are national members. Somewhere along the line we must have failed to provide the sort of services these people expected to find in an organization such as ours, somehow this organization in the eyes of these people is not a progressive responsible, truly professional representative of bio-photography.

It is to remedy some of these lacks and to correct many misconceptions that your officers and Board have bent their efforts in the past few years. Several new directions are being explored and one very durable persistent problem has been tackled anew. Most contributory to the new look is our communications program under the general guidance of Carroll Weiss, our Director of Communications. The impact of his intensive efforts shows clearly in the new regard in which BPA and, incidentally, you its members are being held these days by those highly placed in the various disciplines served by biological photographic personnel. His work is effectively bringing to wider attention the existence of the Association and the aims to which it is dedicated, purposefully building a desirable image which reflects favorably upon the men and women who constitute its membership. In contrast with, but definitely complementing this new dimension, some real strides have been made in the area of standards, with the problem of certification. Your Board feels that you should have a special report from the Committee on Standards, and you will shortly hear from Harold Baitz, its Chairman. Its work is far from complete and here again few have any conception of the scope of the task to which the Committee has been assigned.

Another field in which we feel we have made measurable progress is that of the Journal. In spite of the double load which Leo Massopust carried as President and Editor he has almost alone been able to bring it very nearly current. He was not yet physically up to making the trip here, but sends the heartening message that the May 1960 issue is in press and should be in the mails shortly.

His retirement is imminent and your Board is carefully considering several avenues which will assure continuation of the fine service Leo has rendered. I think we will be able to make a definite announcement in a short time.

I would like to take a final moment to address myself to those of you who for some reason have not seen fit to take a more active part in the Association and its functions. Though it might seem that the very fact of your attendance at this meeting is prima facie evidence of your interest and that it is to those who are not here present that I should point these remarks, I must underscore that it is you upon whom we must depend to carry the message, it is through you that the Association must work to get the light out from under the bushel. A rather major revision of our administrative committee structure is underway. A membership committee is being activated to help extend more services to the member in the field, make a more tangible relationship possible between the Association and the individual. A tape recorded lectures program under the direction of Jack Fason is making fine progress. Already a print exhibition on slides with recorded commentary is available for use by local chapters and is the first of many planned for release in the coming months.

You and all members of BPA will shortly be asked to complete a mail questionnaire exploring your particular fields of interest in bio-photography. This information will enable committee chairmen and others to more effectively utilize your special talents and qualifications.

In the meantime, I urge you to make these interests and your willingness to work for the Association known to me or to any of the other Board members. I invite you to help us serve you more effectually.

We are sorry to announce the passing of . . .

Dr. Chevalier L. Jackson

on January 13, 1961.

Dr. Jackson was associated with the Chevalier Jackson Clinic, Temple University Hospital, Philadelphia, Pa.

BOOK REVIEWS

TRAITE PRATIQUE DE PHOTOGRAPHIE ET DE CINEMATOGRAPHIE MEDICALES. *Edited by Drs. Yves Bruneau, J. M. Dubois de Montreynaud, and J. Jomain. Publications Photo-Cinema Paul Montel, Paris, France, (1960), 304 pp., cloth bound, 26 NF (plus tax) (approx. $10.00).*

For those who read French, this treatise is a catholic summary of the techniques and applications of visual aids in the medical sciences. Its nineteen contributors cover their assigned subjects in short — sometimes telegram-brief — chapters and paragraphs, arranged under three main headings.

The first part of the book is devoted to routine medical photography and cinematography. Various specialists discuss the organization of a hospital photographic service, and the apparatus, techniques, and "professional tricks", for photographing patients, operations, specimens, and microscopic slides. Special chapters are devoted to UV and IR photography, to phase-contrast and interference microscopy, to cineradiography, to copying and reducing roentgenograms, and to optical methods of intensifying contrast. One writer describes and discusses the minimum darkroom and photographic equipment needed by any physician who wishes to keep a routine photographic record of patients in his private office.

Part Two of the book is a detailed account of the current state of endoscopy and endoscopic photography and cinematography. For the professional medical photographer, this section of the treatise, edited and partly written by an outstanding practitioner (J. M. Dubois de Montreynaud), will be the most valuable. Many modern instruments—American, European, Asian—are minutely described, as are the techniques for obtaining good photographs and motion pictures from: larynx, bronchi, esophagus, stomach, colon, rectum, bladder, ureter, vagina, and body cavities. Even the organization of an endoscopic service is described, down to the forms required and typical floor plans.

The third portion of the book is a grab-bag of miscellaneous topics: autoradiography of histologic slides, film dosimetry, closed-circuit TV from the operating room with the Eidophore (a TV camera-projector system suitable for black-and-white or color transmission, using a much larger screen than conventional TV), and color photography through the endoscope.

An appendix lists the characteristics of various film emulsions particularly suited for medical and scientific use.

Because it is encyclopedic rather than exhaustive in depth, experienced professionals will find little use for this treatise, except when they may wish a quick summary of a technique with which they are not well acquainted. For beginners, for doctors who want to know the limits and possibilities of medical photography, for hospital planners, and for students the book is a valuable text (provided they read French). Its most glaring defect is the lack of references to more specialized articles and books, of which only a very few are given.

T.R.M.

MIKROPHOTOGRAPHIE, *by Prof. Robert Schenk, M.D., and Gonzague Kistler. S. Karger, AG, Basel, Switzerland, (1960), SFr. 18.00, 152 pp., cloth bound.*

This well planned book constitutes a complete text on photomicrography with the still-camera. It opens with an excellent description of microscopes, their optics, light sources, and cameras, then proceeds to a clearly explained set of rules and techniques for "getting the most out of a microscope". Other chapters discuss film and format, filters, exposure, developing, printing, and storing of films. Wherever necessary, theoretical arguments precede practical advice. Color photography, and the processing of color transparencies and prints are clearly described, and special sections are devoted to phase-contrast, dark-field, polarized light, fluorescence, and electronic flash, photography. The final chapter constitutes a check-list of "things to do" when assembling and testing a new photo-

micrographic laboratory, or a new piece of equipment.

An appendix has 23 tables, listing useful film-types, the characteristics of various light sources, filter factors, developers, and conversion factors (European-American). There is a brief, but well selected bibliography of German-language books concerning different aspects of photomicrography.

For those who read German, this book is a concise, clear, and reasonably complete survey of the practical aspects and theoretical background of photomicrography.

T.R.M.

Repairing Light Leaks in Camera Bellows

Some time ago we discovered that one of our over-worked photomicrographic camera bellows was developing corner abrasions which would soon become a source of troublesome light leaks.

An immediate attempt at repair with available opaque gummed tape proved to be a very temporary expedient which eventually caused further damage. Since the bellows was a discontinued type that could not readily be replaced or repaired, we consulted with our research division and were offered the suggestion that we try the opaque liquid compound used for topping museum jar preparations (a superior substitute for animal membranes).

We proceeded, after a patch test, to apply the topping compound to the many defective areas on the bellows. The resulting tough, elastic film bonded permanently with the fabric. It had, in fact, restored the equipment to full usefulness and added many potential years of service.

Since this is the sort of problem that may occasionally crop up in the field of scientific photography, we are glad to supply the following information on our bellows repair method:

Apply Turtox Topping Compound externally with a brush where needed and allow the coating to dry for an hour. (If the fabric is badly abraded, several coats may be necessary.) This is followed by a coating of Turtox Finishing Lacquer to produce a non-tacky finish. After the treated bellows have remained in an extended position for 24 hours, they are again ready for normal use. The last coating may be eliminated if, for the first few days, care is exercised to store the camera with the bellows partly extended when not in use.

315A715 Turtox Museum Jar Topping Compound. Pint . . . $2.25

315A7155 Turtox Finishing Lacquer. 4 ounces 35

Reprinted from Turtox News. Published by General Biological Supply House, 8200 S. Hoyne Ave., Chicago 20.

New Products

FLUORESCENCE MICROSCOPY AIDING MEDICINE, CHEMISTRY

A newer way of diagnosing cancer and solving immunization problems in medicine and biochemistry has gained widespread application, the Tenth Annual Instrument Symposium and exhibit at the National Institutes of Health here reveals.

The method is fluorescence microscopy. Invisible light in the blue and "colder" ranges of the spectrum is beamed to the molecules of a cell or other specimen, exciting it into "self-luminescence" so it shows itself with clearer differentiation than ever before.

First the specimen is treated with a special dye. Molecules then absorb the exciting light in such an interaction that visible light is re-emitted. This fluorescence is somewhat like the photo-luminescence on an X-ray screen.

Important recent advances have been made with the discovery of special dyes and the design of new fluorescence microscopes. Technics evolved from the classic principles of fluorescence and introduced by such scientists as Coons and Kaplan, have opened new areas to scientific scrutiny.

On Sept. 28, 1960, the first symposium was devoted to the role of fluorescence in biology today. Sidney Udenfriend of the National Heart Institute was chairman.

Today the newest instruments are being shown and described to scientists of six major societies in chemistry, bacteriology and related fields.

Much interest has been expressed in the scheduled appearance of a new fluorescence microscope designed by Ernst Leitz of West Germany. Dr. Peter Bartels, director of the microscopy laboratory of E. Leitz, Inc., New York, will describe it at the company's exhibit.

Dr. Bartels has been giving papers on the optical principles of fluorescence microscopy, at the Communicable Disease Center in Atlanta, for example, and before groups of pathologists and other scientists around the country.

"The tremendous sensitivity of fluorescence staining makes it an invaluable tool for bacteriologists and immunologists," Dr. Bartels pointed out.

To study the antibodies produced by the human body in defense against infectious and other injurious material, he explained, scientists are now making particularly good use of the sensitivity of the fluorescence method, ranging between the detectability of radioactivity and the sense of smell.

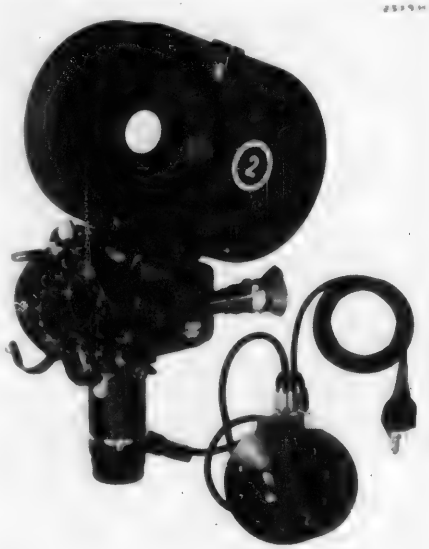
The minimum detectable amount of fluorescent matter is about 1/1,000,000,000,000,000,000 gram, or a billionth of a billionth gram.

Fluorescence microscopy has already helped in the search for exactly where in the body immunization takes place, because both antigens and antibodies can be "labeled" for study.

ARRIFLEX 35-IIB-S NOW AVAILABLE IN LIMITED QUANTITIES

The Arriflex Corporation of America announces the availability of a special model of the Arriflex 35. The camera is available in limited quantities for immedate delivery and is designated as the Arriflex 35-IIB-S.

The camera is equipped with a specially selected and balanced movement, and a special 32 volt DC motor, for operation to 80 frames per second. The motor is equipped

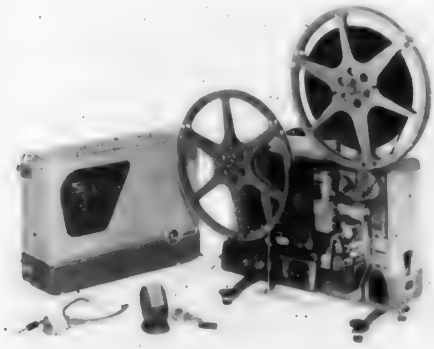


with an external rheostat for speed control and the circuit is designed so as to maintain high torque even at lower speeds. The camera is equipped with a special tachometer, calibrated to 80 FPS.

The Arriflex IIB-S is expected to find important applications in those areas where it is desired to have a fine 35mm camera with high capability in both instrumentation and documentation uses. The camera will accept all Arriflex 35 standard accessories, and will sell for $1,995.00 with special motor and speed control, less lenses and magazines. Further information is available from Arriflex Franchised Dealers, or the Arriflex Corporation of America, 257 Park Avenue South, New York 10, New York.

BOLEX S-221 PROJECTOR INTRODUCED

With the newly introduced Bolex S-221 projector, the 16mm movie maker now can professionally reproduce optical or magnetic sound with true high fidelity. Complete unit



consists of 8-inch speaker built into its removable lid; 2000-foot film reel; microphone with 13-foot cord with jacket; earphone; 50mm f/1.3 Hi-Fi projection lens; and (not shown) a heavy-duty plastic travel case.

ARMED FORCES MEDICAL MUSEUM GETS HISTORIC LEITZ MICROSCOPE

Now Has Twenty-Two; They Date to 1885

Another historic microscope has been added to the world-famed almost century old medical museum of The Armed Forces Institute of Pathology at the Walter Reed Army Medical Center here.

The museum's directing officer gratefully acknowledged receipt from E. Leitz, Inc. of a research microscope made in 1920, to "fill an important gap in the comprehensive collection of historic microscopes." He said the motto of the museum's microscope hall is, "The progress of medicine is measured by the progress of its instruments."

Col. Frank M. Townsend said there are now 22 models of Leitz microscopes in the venerable hall, the earliest dating to 1885. "Your cooperation and interest in (our) endeavor to acquire and preserve for posterity these valuable instruments are sincerely appreciated," he said.

Ernest Leitz of West Germany was the first to produce microscopes of high quality, in quantity, for the world's scientists.

E. Leitz, Inc., American distributors, obtained the 1920 instrument from Wetziar, Germany, for the museum.

Henry Mann, president, said, "It is extremely gratifying to us to be able to make this contribution to one of the finest scientific museums in the world, which traces the history of instrumentation and shows the important role of optics in medical research."

The Armed Forces Institute of Pathology was founded under Surgeon General William A. Hammond in 1862, when the Civil War created unprecedented medical problems for the Nation. In addition to the Medical Museum and a large collection of visual aids used in medical education here and abroad, the Institute consists of a Department of Pathology serving research throughout medicine; and the American Registry of Pathology, sponsored by 17 national medical associations in cooperation with the National Research Council. Laboratories for tissue culture, cytophysics, histochemistry, radiobiology and microbiology serve in thousands of civilian as well as military medical problems.

A unique feature of the Institute is the vast collection of well documented medical and surgical cases, with related pathologic specimens and illustrative material including a quarter of a million photographs, so that scientists can follow a population of 12,000,000 from youth to old age in the study of public health.

Basic research in a true academic environment has earned the Institute a distinguished reputation, it has been said, and the names of Reed, Woodward, Callendar, Lucke, Ash

and Wilder recall some of the many significant contributions.:

Progress in optics and glass technology has been followed closely and applied by the Institute. "Now pathology may be on the threshhold of another revolution," its staff has pointed out.

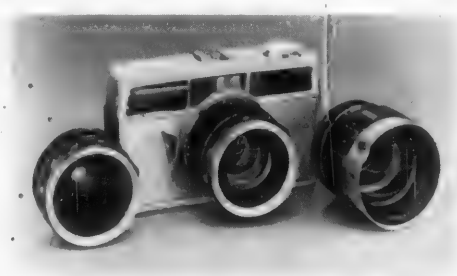
It is no accident that the microscope is over the motif of the seal of the Institute, its historians explain. The collection of over 500 antique and modern instruments is perhaps the most comprehensive in the world. Although microscopes have been used there since 1862, the collection was begun in 1884.

ANSCOMARK M ADDED TO ANSCO PRECISION CAMERA LINE

Ansco, Binghamton, New York, has announced the Anscomark M, a 35mm precision camera designed for the quality-conscious camera user who wants the finest in an interchangeable lens camera with coupled exposure meter control.

According to James P. Demaree, Marketing Manager for Ansco's Amateur Products Division, the Anscomark M represents the greatest value in precision automatic cameras.

The Anscomark M viewfinder permits simultaneous viewing and focusing with all lenses. It features parallex corrected bright color-coded frame outlines for use with each of the



interchangeable lenses including normal, wide angle, and telephoto. The parallex correcting finder functions accurately at all distances from 3 feet to infinity.

The Anscomark M "match needle" meter controls permit the user to pre-select either shutter speed or lens opening on separate control rings and adjust the exposure accordingly by aligning the meter indicators.

The shutter and aperture controls may be operated independently or jointly without disturbing the basic correct exposure. The meter covers a wide range of lighting conditions and a full range of film speeds. A metal protective shield acts as a shade to prevent erroneous sky readings.

The Anscomark M shutter and lens mount is designed to support the lens directly to the camera body—the shutter mount is thus safely enclosed . . . away from accidental damage. The interchangeable lenses are safely locked in the mount, yet easily changed. The shutter is designed so the user can safely change to any speed, including 1/500th sec. whether or not the shutter is cocked.

Synchronization is full M-X type with self-timer. A unique "lock" prevents accidentally changing the synchro-settings.

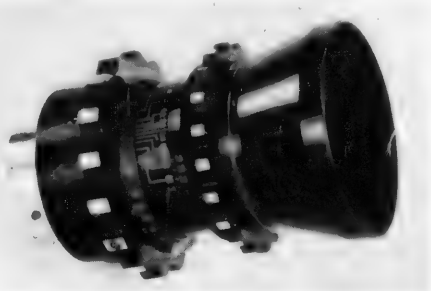
The Anscomark M comes equipped with an f/1.9 Xyton or f/2.8 Xytar—50mm lens. An f/3.5 Xyton—35mm wide angle and an f/4 Xyton—100mm telephoto lens are available.

List Prices:

Anscomark M with 50mm f/2.8 lens	*$134.50*
Anscomark M with 50mm f/1.9 Lens	*159.50*
Case	*12.50*
35mm f/3.5 wide angle lens and case	*59.50*
100mm f/4 telephoto lens and case	*79.50*

NEW BAUSCH & LOMB SUPER BALTAR LENSES DESIGNED FOR MOTION PICTURE, TELEVISION AND SPECIAL APPLICATIONS

Bausch & Lomb announces a new series of Super Baltar Lenses designed for motion picture, television and special purpose applications. The Super Baltar, which marks B&L's



continued research in the field of photographic technology, will supplement the Company's present line of Baltar Lenses.

Following in the tradition of the Baltar, the Super Baltar series incorporates a newly designed optical system. Made from new glasses

of high index, the Super Baltar has excellent resolution and the most even distribution of light ever offered in a motion picture camera lens. The new series will include a choice of eight lenses, with focal lengths ranging from 20mm to 9" (speed of f2.0, both f to t stopped). All focal lengths cover 35mm motion picture frame, and lengths from 3" to 9" cover 70mm frames. Back focal lengths range from 33mm to 133mm.

Special design of the optical systems allow the Super Baltars to be used not only for feature and newsreel motion picture photography, but to meet specifications needed for television, commercial and military use. Engineering facilities make it possible for Bausch & Lomb to offer custom design service to adapt these lenses to individual focusing mounts for camera and other manufacturers. As an example, Super Baltars will first be seen on the new Mitchell R-35 Cameras.

Details on the new Baltar series may be obtained by writing to Photographic Sales Department, Bausch & Lomb Incorporated, Rochester 2, New York, specifying Bulletin #F-162.

PLAUBEL POLAROID 4¼" x 4¼" SUPERWIDE

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Complete detailed information is available upon request.

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JOURNAL OF THE

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JOURNAL *of the* BIOLOGICAL PHOTOGRAPHIC ASSOCIATION

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The Problem of Depth of Field in Photomicrography

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AN investigation of the nervous system of the skin by means of stained microscopic sections presented problems in photographic documentation because of vertical as well as horizontal ramifications of nerve endings. Some attempts at solution of the problems encountered with respect to depth of field are offered.

General Background

While this paper deals with a particular phase of photographic depth of field, it might not be amiss to consider briefly general aspects of depth of field and to review some suggested methods of achieving greater depth of field in photomicrography.

Depth of field refers to the distance from the nearest to the farthest objects that appear in sharp focus on the viewing screen of a camera. To a certain degree, this depth depends on the inability of the human eye to distinguish between a point and a slightly unsharp point, which may be referred to as a "circle of confusion." In ordinary photography, a circle of confusion of 1/250 of an inch may be considered acceptable.

Depth of field decreases greatly as the lens-to-subject distance lessens. Reducing the aperture of the lens diaphragm results in increased depth of field. In photomicrography, this effect can be achieved to some extent by stopping down the substage diaphragm. Assuming Koehler illumination as basic, this technic can reach the point where impairment of the image results through diffraction of the light.

Other optical means of achieving greater depth of field in photomicrography include the use of an objective with the lowest possible numerical aperture (that is, lower initial magnification), with magnification attained by use of an ocular of higher power or increased extension of the bellows or both. It should be noted that resolution decreases as the numerical aperture is reduced. Also recommended is reduction, by means of a diaphragm of the aperture plate, of the objective. This is not always possible. However, the increase in apparent depth of field by these methods is indeed limited.

The problems are not lessened by the fact that the range of accommodation of the eye permits seeing greater depth than can be recorded on film, and this is aside from the "focusing while scanning" technic used by every microscopist.

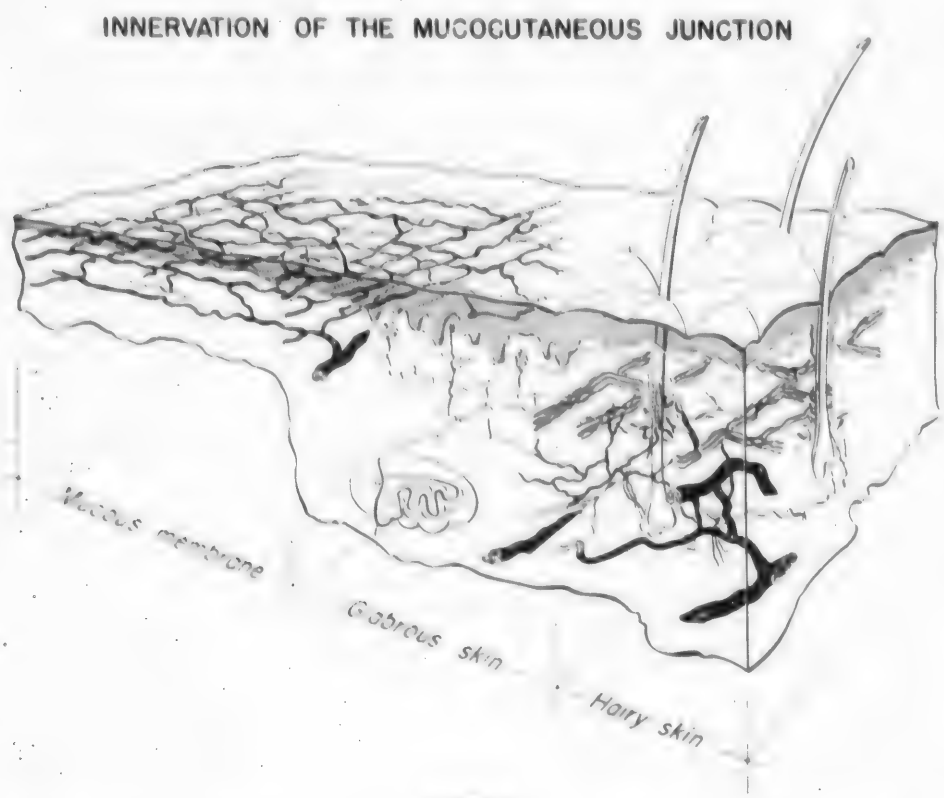
Technics Used in Present Study

Microscopic sections were prepared by the frozen-section technic, which more nearly preserves complete nerve

patterns with minimal distortion. The tissues were stained by a rapid silver-impregnation procedure that left the nerve fibers black and provided good contrast between nerve and connective tissue.

The morphologic arrangement of nerve structures responsible for sensory innervation of the skin involves three zones, namely hairy skin, glabrous (smooth) skin and mucous membrane (Fig. 1). In terms of frozen sections 50 microns thick, the photographic problems become apparent. Careful selection of the field can result in excellent pictures by straightforward photography (Fig. 2). In many instances in this study, it became apparent that resort to other than strict optical means would be necessary.

The technics to be described are neither new nor novel. Variously, they embrace simple double exposure at separate levels, multiple negatives made at successive depth levels and printed through superimposition or as a mosaic



LEGENDS

Figure 1. Diagram showing innervation of the mucocutaneous junction. (Reproduced with the kind permission of the author and publisher from Winkelmann, R. K.: Nerve Endings in Normal and Pathologic Skin: Contributions to the Anatomy of Sensation. Springfield, Illinois, Charles C. Thomas, Publisher, 1960, 195 pp.)

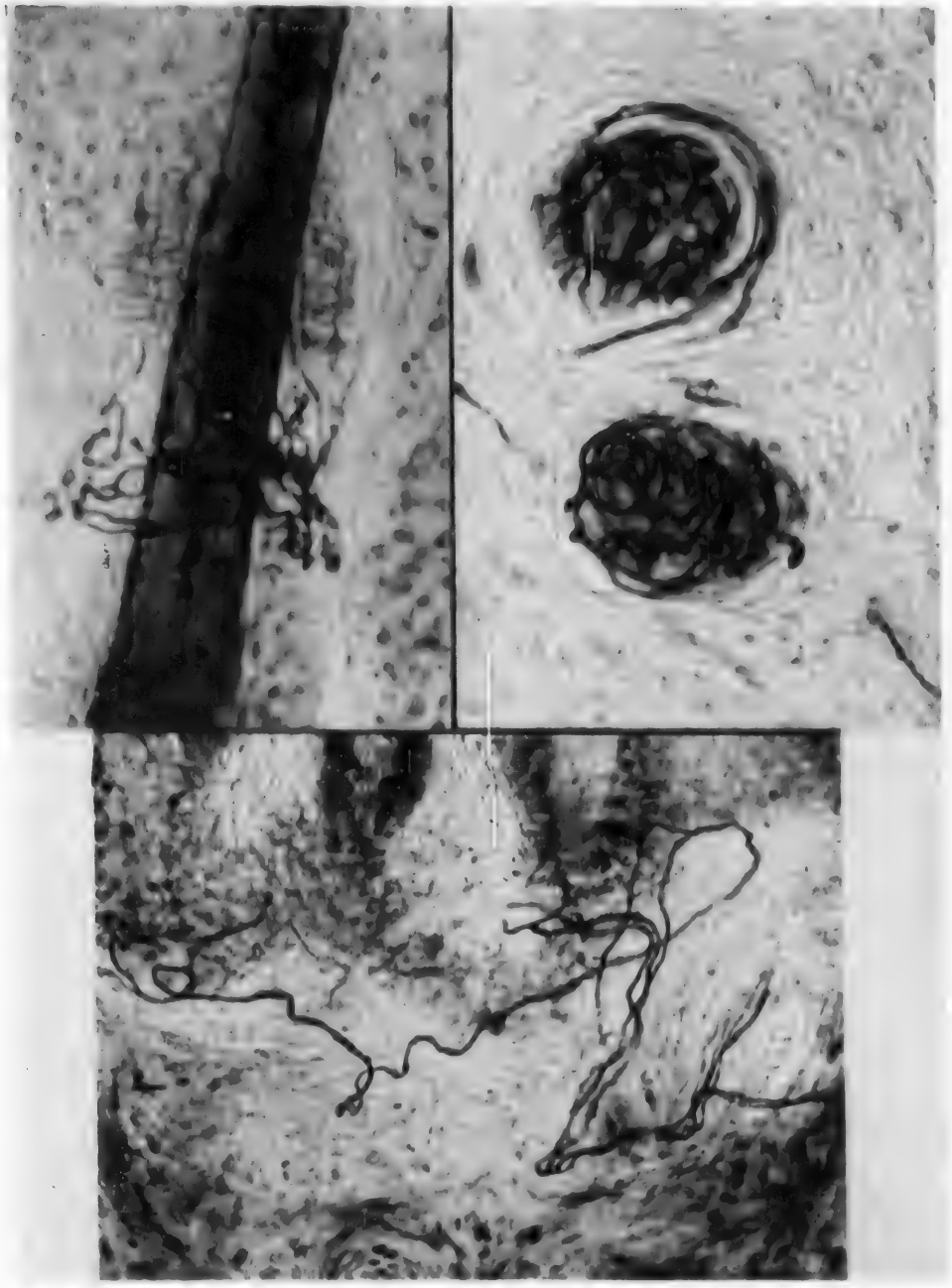


Figure 2. *a.* Sensory end-organ of hair follicle (x165). *b.* Two typical end-organs in glabrous skin (x620). (Reproduced with the kind permission of the author and publisher from Winkelmann, R. K.: Nerve Endings in Normal and Pathologic Skin: Contributions to the Anatomy of Sensation. Springfield, Illinois, Charles C. Thomas, Publisher, 1960, 195 pp.) *c.* Nerve pathways in mucous membrane (x225).

of the individual prints, and "rolling" or continuous focusing through the necessary range of depth as the exposure was made. The method chosen in any one instance depended on the visual estimation of the complexity of the nerve network.

Figure 3 depicts a double exposure at two levels to record both ends of a nerve fiber in the lip.

Lateral distribution accompanied by vertical disparity of the nerve fibers was recorded on multiple negatives (Fig. 4), from which was made a mosaic (Fig. 5). A suggestion for which the

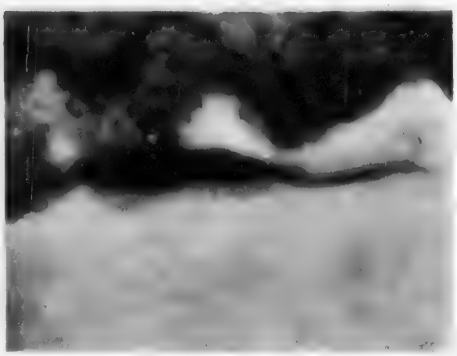


Figure 3. Double exposure at two levels recorded both ends of this nerve fiber (x310)

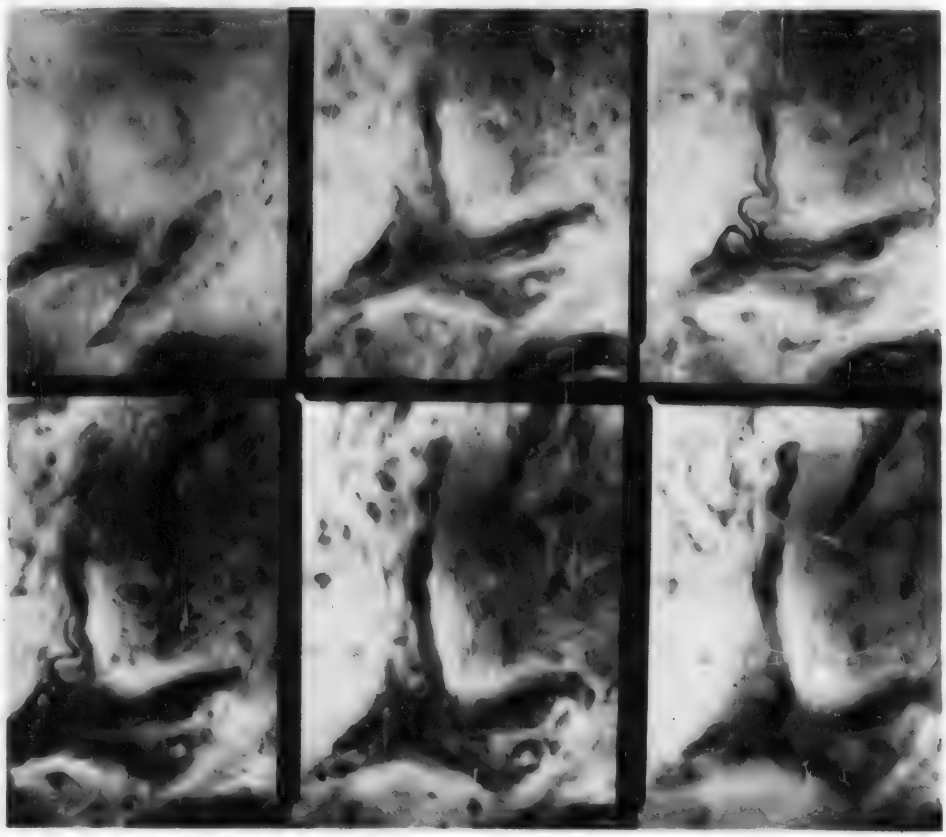


Figure 4. Portions of these six prints were combined to make the finished mosaic in Figure 5

Figure 5. Mosaic made from the six prints seen in Figure 4 (x650).

Figure 6. Method of tearing photographic prints in making mosaic prints.

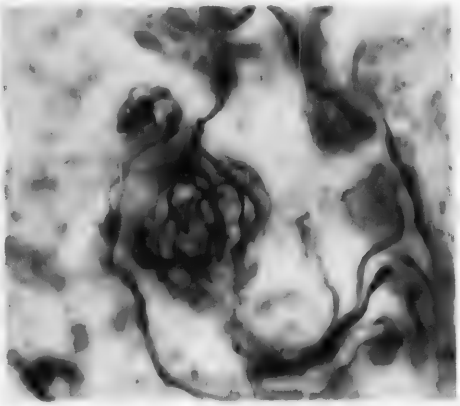


Figure 7. Print from a copy (positive negative) of a four negative pack (x675). (Reproduced with the kind permission of the author and publisher from Winkelmann, R. K. The Muco cutaneous End organ: The Primary Organized Sensory Ending in Human Skin. A.M.A. Arch. Dermat. 76:225 235 [Aug.] 1957.)

author was grateful some years ago may be helpful in this regard. In cutting prints for a mosaic or montage, cut through the emulsion only, then tear away one side carefully, leaving a "feathered" edge that requires little sanding for close matching and reduces the time spent retouching overlapping lines (Fig 6)

Although this technic is successful, considerable effort is involved. The same results may be achieved by superimposing multiple negatives, although not so many as in Figures 4 and 5. A two-negative pack may be printed by contact, but use of more than two negatives requires projection printing or the production of a new negative by the positive transparency-negative method (Fig. 7).

The superimposition of several negatives may require special handling of some of them, as in the three negatives in Figure 8. One negative, which may

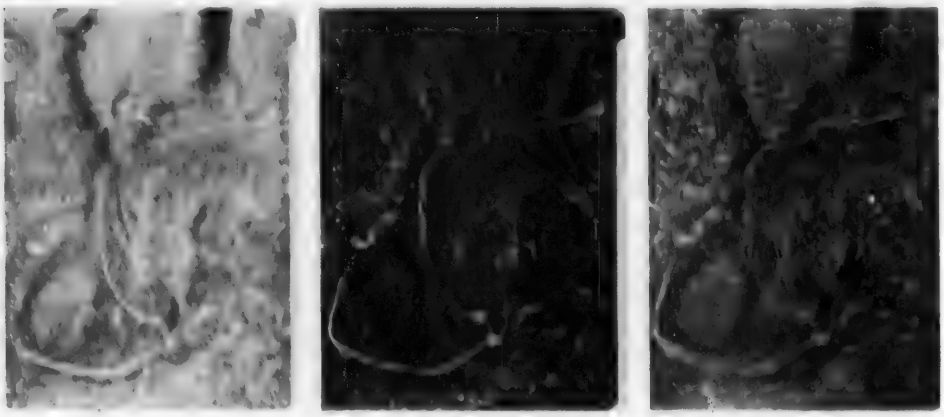


Figure 8. Example of one type of special treatment. The center negative received normal exposure and development; the other two negatives were exposed and processed for minimal background detail, yet to retain nerve fibers.

Figure 9. Print by projection from the combined negatives in Figure 8 (x350). (Reproduced with the kind permission of the author and publisher from Winkelmann, R. K.: Cutaneous Nerves in Relation to Epithelial Tumors. J. Invest. Dermat. 27:273-279 [Nov.] 1956.)

be called the "base" negative, was given normal exposure and development. The others received about one quarter of the normal exposure, which kept the overall density at a minimum and yet retained the essential nerve pathway. These negatives were superimposed and a composite print made by the means indicated earlier (Fig 9).

In some sections, the collagen of the dermis may contribute unduly to the density. In these situations, chemical reduction of one or more negatives may be necessary to achieve a balance that permits the making of a suitable print.

Other methods of altering the density of portions of a negative are available. Photographic masking is a possibility. This involves making a weak positive that is bound in register with the negative; this "sandwich" then may be printed directly. Another technic utilizes sheets of coated celluloid that are available in varying densities and tints, such as Bourger sheets. These sheets are placed over the negative and the coating is removed from the desired areas; in this instance, they are

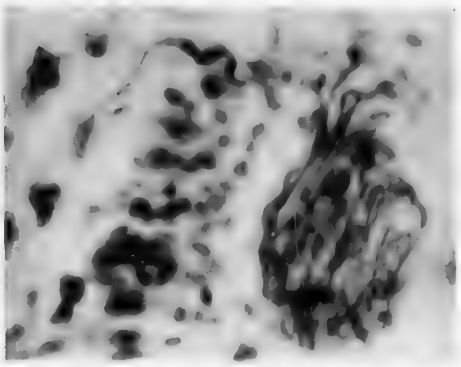


Figure 10. An end-organ in depth recorded by the "rolling" technic (x670). (Reproduced with the kind permission of the author and publisher from Winkelmann, R. K.: The Muco cutaneous End-organ. The Primary Organized Sensory Ending in Human Skin. A.M.A. Arch. Dermat. 76:225-235 [Aug.] 1957.)

the nerve fibers. When bound in register with the negative, the net effect is an increase in contrast through increased density in the connective-tissue background.

The technic of panning or "rolling" during exposure may be used. While the relationship of movement of the tube to rotation of the fine-adjustment knob varies with the type of microscope, a general estimate would equate a change of one division on the fine-adjustment knob to a tube change of 1 micron. After the proximal and distal levels in the tissue are determined and the corresponding reference points on the fine-adjustment knob are noted, the illumination is adjusted, basically by the optical components and additionally by neutral density filters, to effect an exposure of sufficient duration to accomplish the "rolling" through the predetermined arc of the fine adjustment (Fig. 10).

A stereophotograph was attempted in one instance through a built-up pile of positives. Seven negatives were made to record a similar number of levels of a nerve complex. In six negatives, all but the visible segment of nerve was opaqued, whereas the seventh negative provided the necessary background. A positive slide was made from each negative, and the pile was built up in the sequence level in which the negatives were made. Photographed in stereo, it showed a satisfactory depth effect.

Conclusion

By one technic or another, it is possible to photograph many of the sensory end-organs of the skin in their complexity. Some aspects of these technics have not been demonstrated previously.

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Journal of the Biological Photographic Association Vol. 29, No. 2 May, 1961

Principles of Ultraviolet Light and Some of Its Applications in Photography

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IN the last decade the ultraviolet light sources have been used more frequently in medical and research work and in photography relating to these fields. In crime detection it is a very useful tool and has helped to solve many mysterious cases. This paper will give you the different aspects of ultraviolet light in connection with photographic lenses, filters emulsions and some applications which are very useful in research work.

In order to explain the behavior of the ultraviolet rays of the spectrum, I will first give you a brief review of the theory of light.

There are two types of light: 1) incandescent light caused directly by heat; 2) luminescent light which is not directly attributable to heat like a) bioluminescence (lighting of the sea; a firefly), b) chemoluminescence, c) fluorescence, and d) phosphorescence. Besides visible light rays with wave lengths from approximately 400 mμ to 700 mμ, there is a wide range of electromagnetic rays with wave lengths from 400 mμ down to 0.1 mμ or 1 Å unit

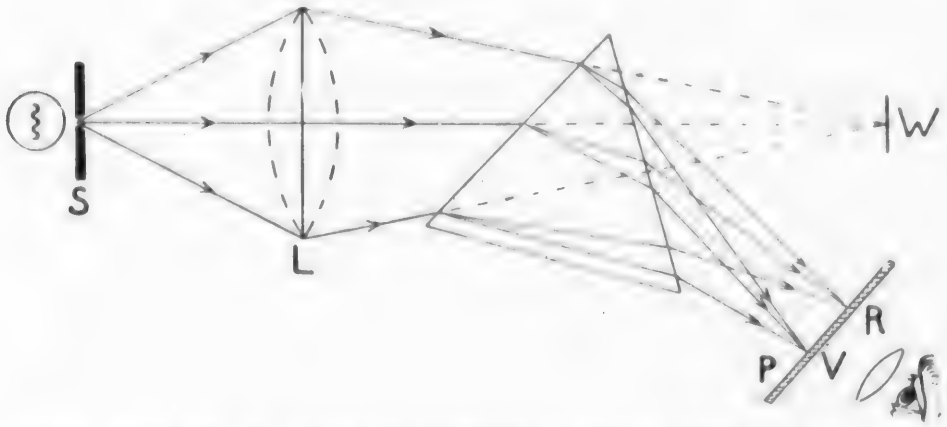


Figure 1. White light can be split into a spectrum of colors by means of a prism. This is known as dispersion.

or less. From 760 mμ up to 10 mμ is the infra-red and there is also electromagnetic radiation with wave lengths from 700 mμ to several miles. From 440 mμ down to approximately 1 mμ is the ultraviolet region.

In 1800, Sir William Herschel discovered the infra-red region of the spectrum. The ultraviolet light was first discovered by Ritter in 1801. He noticed the blackening of certain silver salts by the action of a band of invisible radiation beyond the violet light.

Most photographic silver halide emulsions are sensitive to ultraviolet rays as are some other non-silver emulsions; e.g., the diazo emulsions. Before continuing with photographic applications it is necessary to explain some of the elementary facts relating absorption and emission spectra to chemical structure; in this case, to electronic absorption or, in other words, to absorption and emission of ultraviolet light.

There are two types of spectra which are classified in the following way:

1) Emission spectra,
2) Absorption spectra.

The emission spectra are subdivided into a) continuous spectra and b) bright line spectra. Continuous spectra are given by incandescent solids and liquids as white hot iron, etc. Bright line spectra are given by incandescent vapors and gases; e.g., electric sparks, vacuum tubes, colored flames of arcs.

The absorption spectra also are divided into two main types: a) continuous absorption spectra and b) line absorption spectra. A good example of a continuous absorption spectrum is the spectrum of blood which has dark bands in the orange and yellow and in all the violet and ultraviolet parts of the spectrum. An example of a line absorption spectrum is the spectrum obtained when very intense white light is passed through a sodium flame; a dark line appears at 589 mμ, the so-called sodium line. At the moment we are mainly interested in fluorescence and the continuous absorption spectra.

The principle of light emission can be related to temporary structural changes in the atom. Let us have a look at the atom. See Figure 2. It consists of a nucleus with positive charge around which are circulating electrons with negative charges. The number of electrons is equal to the net positive charge of the nucleus. The electrons move around the nucleus in a number of orbits, each representing a certain energy level.

Light as we know is energy. When it hits an atom, it is absorbed by the electrons and because of the extra energy, one or more of the electrons which are circulating around the nucleus may be knocked to another circle. Now this electron will soon jump back to its original circle and release the energy which it had obtained. This energy is emitted as light. The emitted light has the same wave length as the absorbed light in this case. However, the electron often jumps more than one orbit; for instance, from circle 1 to circle 4. On its way back, it returns step by step from circle 4 to 3, 3 to 2, etc. This means that with every step it releases only a part of the originally absorbed energy and according to the physical laws the wave length of the emitted light will then be longer than that of the absorbed light. This process is called fluorescence. In most cases, ultraviolet light gives a stronger fluorescence than does visible light, because it has a higher energy content.

The difference between fluorescence

and phosphorescence is that with the latter a whole complex of molecules takes part in the process so this happens usually only in solids while fluorescence happens with solids as well as with gases and liquids. Also in phosphorescense, there is a delay in light emission; i.e., the emission continues after the radiation is stopped.

The many types of ultraviolet light sources give a rather wide range of wave lengths usually including some visible light. Because we usually need only a small part of the ultraviolet region and want to exclude any light of the same wave length as the fluorescence, we have to use filters which may be made of gelatin, glass or liquids. The difficulty with filters is that there is a possibility of fluorescence which causes an over-all haze in the image, decreasing its detail. With gelatin filters between glass it occurs that one side of the filter has a higher fluorescence than the other side which may have little or no fluorescence at all. The reason is that the two cover glasses are coated with different stains of which one fluoresces

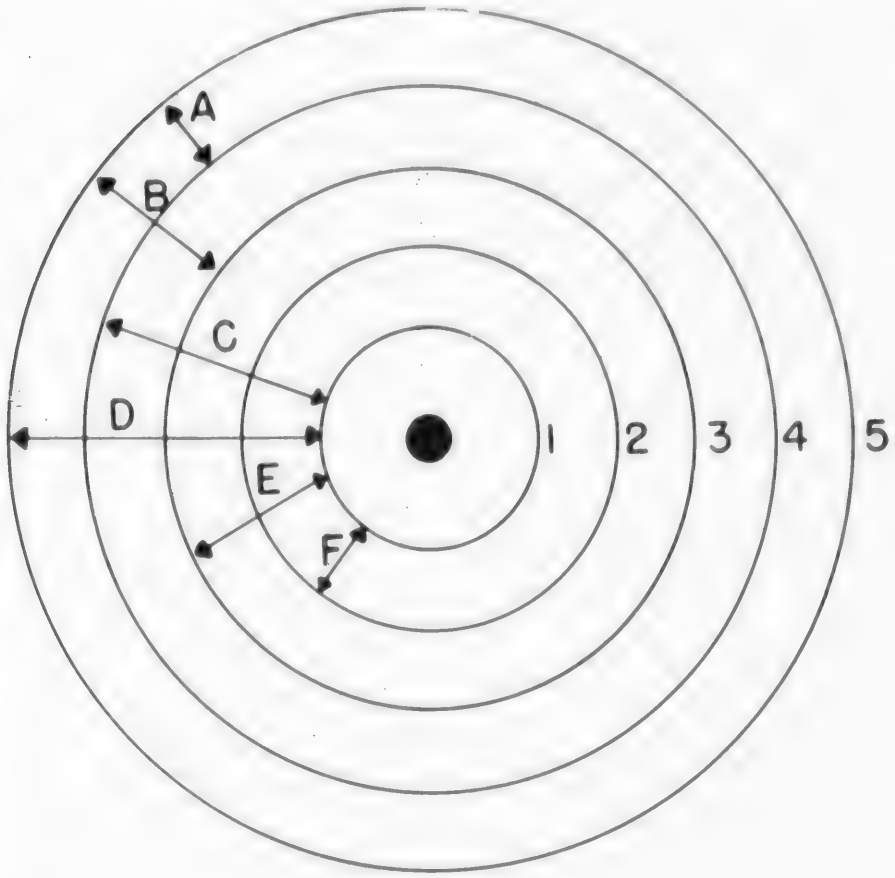


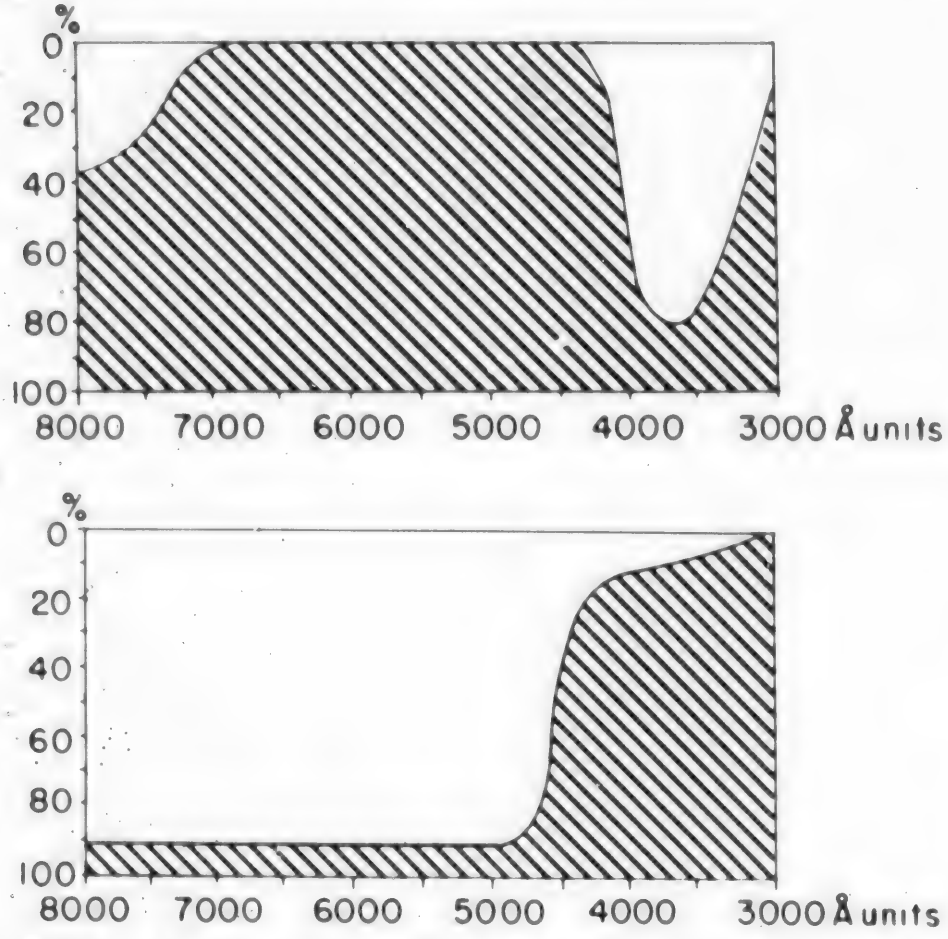
Figure 2.

and the other does not. Apparently the non-fluorescing side absorbs so much ultraviolet light that when it is turned towards the light source the filter won't fluoresce.. Sodium nitrite and potassium chromate liquid filters are very satisfactory and have no fluorescence.

The ultraviolet rays from 3130 Å units down are dangerous to the eyes. Therefore, when working with wave lengths below 3200 Å you have to use eye glasses. Any kind of glass is all right. The most commonly used glass is Crown glass which only transmits light to 3300 Å units.

The common photographic lenses have no trouble with fluorescence. The Canada balsam coating is so thin that it will not fluoresce.

The modern highly corrected lenses with several heavier kinds of glass will absorb approximately two-thirds or



Figures 3 and 4. We may use either positive (Fig. 3) or negative (Fig. 4) ultraviolet filters. The positive ones absorb the visible light and transmit certain ultra-violet wave lengths while the negative ultraviolet filters are just the opposite.

Name	Thickness	Wavelength in Å units							
		3022	3130	3342	3665	4047	4358	5090	5461
UG1	1mm	17	37	69	85	8	0	0	0
UG2	1mm	27	50	80	84	2	0	0	0
UG3	1mm	0	4	55	91	85	50	12	15
UG4	1mm	9	22	59	77	7	1	1	2
UG5	1mm	98	99	98	91	39	11	1	0
CG4	1mm	0	0	3	1	40	67	95	97
CG7	1mm	0	1	4	5	12	16	99	99
CG8	1mm	0	0	0	0	5	26	88	99
CG9	1mm	1	1	0	0	1	14	88	93

Figure 5. This shows filters from Schott, Jena, Germany and Corning Glass Works U.S.A.

more of the light at the 3670 Å wave length which is the mercury-vapor line. The loss of light in a lens caused by reflection is high. Fig. 7.

Glass with a high refraction index has a high reflecting power. The method used to reduce the reflection is to apply a thin transparent coating to the surface which results in a difference in phases of the two reflected light rays — one reflected by the glass surface, the other by the coating. When this difference in phases is so large that interference occurs, then the reflection has reached its minimum. To reach the point of interference the thickness of the coating must be one-fourth of the wave length of the reflected light. The best kind of coating should have 1) maximum optical capabilities, 2) high mechanical resistance, and 3) be water insoluble.

In theory the coating actually only works well at specific wave lengths. Fig. 8, 9, 10.

But now there is trouble with the photographic gelatin emulsion because the gelatin absorbs too much below 2300 Å units. There are several ways to solve this problem. For instance, Agfa and Ilford solved it by using as little gelatin as possible. The plates manufactured by Agfa named after their inventor, Schumann. These are sensitive from 1800-900 Å units. The Ilford plates, the so-called Q-plates, are extremely valuable. The plates are sensitive from a few Å units till about 2000 Å units, so from very soft X-rays to ultraviolet rays of short wave lengths.

A quite different way is to coat the emulsion with a very thin layer of a fluorescence substance; e.g., immerse the plate in a 5 per cent solution of alcohol and sodium salicylate which gives the plate a sensitivity from 700 Å units up to 3000 Å units. The beforementioned thin layer changes the short wave length into a longer wave length.

In photomicrography there is, sometimes, a use for ultraviolet light. One advantage is that by using shorter wave lengths the resolving power of a non-

self-luminous object, the following formula is used:

$$d = \frac{0.50\lambda}{N.A.}$$

d — distance between two adjacent elements which can just be resolved in the image;
λ — wave length of the light;
N.A. — numerical aperture of the objective.

For *self-luminous objects*, resolving power is slightly less:

$$d = \frac{0.60\lambda}{N.A.}$$

In *Tricks and Treats in Photomicrography* by H. W. Zieler, the author gives a clear explanation of these formulas.

Another application of ultraviolet wave lengths is in paperchromatography. This is a method of separating different compounds in a solution on filter paper. For example a mixture of purines and pyrimidines, breakdown products of the nucleic acids, can be separated in this way by the use of solvents moving along the paper surface. These compounds absorb ultraviolet light at 2540 Å units. This allows the localization of these compounds on the chromatogram by visual observation of the filter paper, using an ultraviolet light source with a positive filter. The compounds will be seen, because of their ultraviolet absorption, as dark spots against a soft violet background.

One of the recent photographic applications of ultraviolet absorption at Presbyterian-St. Lukes Hospital consists of making photographic records of paperchromatograms. Since paperchromatograms do not keep very well, photographic records are necessary.

While exposing the paperchromatogram to ultraviolet radiation you have to be very careful about selecting the wave length and the intensity of the ultraviolet light. Some compounds such as thymine and iso-guanine for example may decompose and will not absorb the ultraviolet light at certain wave lengths.

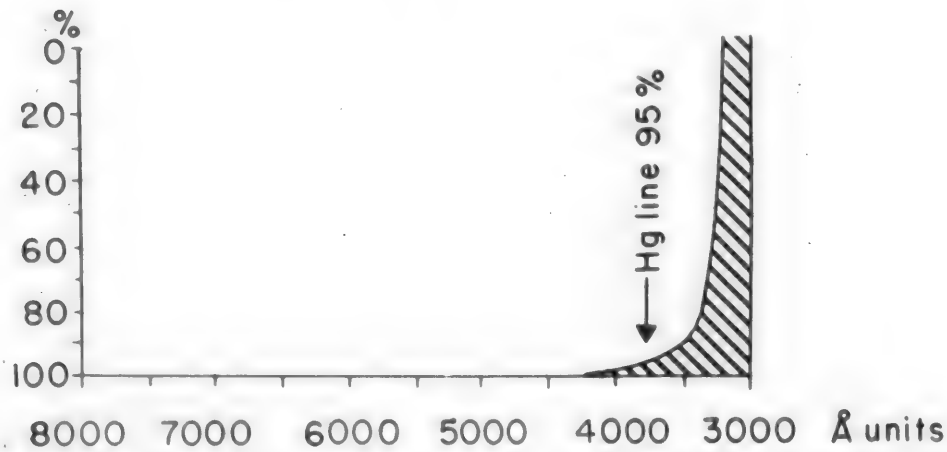


Figure 6. Crown glass transmits ultraviolet light as low as 3300 Å units, so the important mercury-vapor line at 3665 Å units, can still be used for approximately 90 percent.

There are several methods of obtaining reproductions of paperchromatograms. With any of the following five methods one can use oil to make the paperchromatogram semi-transparent. This oil has to be light mineral oil or a mixture of a similar oil diluted with a solvent such as iso-octane. The oil should not fluoresce when exposed to ultraviolet radiation at wave lengths of 2400 to 3800 Å units.

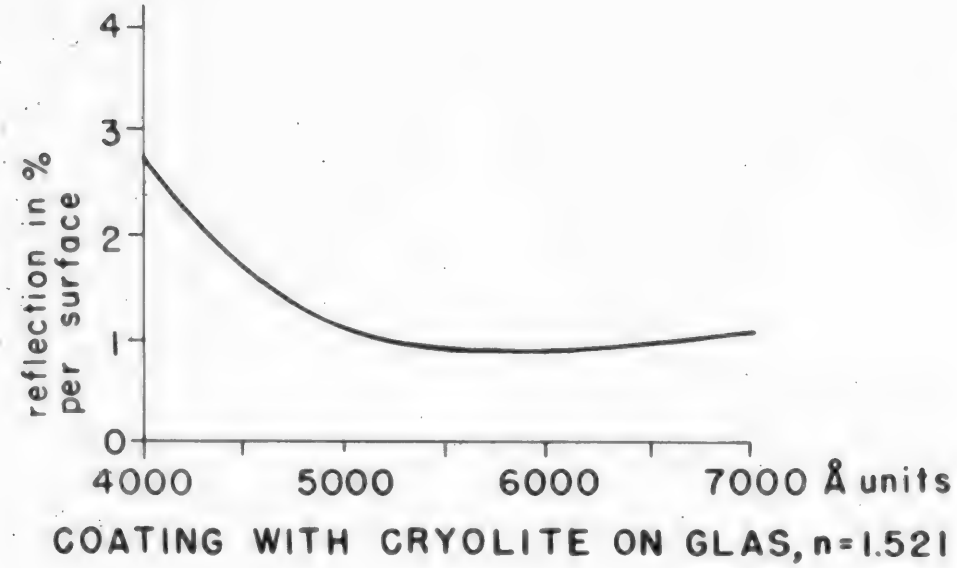
(1) The silver-halide processes of detecting and recording the presence of ultraviolet absorbing spots are superior to the other methods because (a) the process is very sensitive with or without dipping or spraying the paperchromatogram with oil, (b) the exposure times are very short, and (c) the record is permanent. But you must use a darkroom. The processing takes more time and effort. This should not be a drawback because you can expect that modern research laboratories will have at least one biological photographer who can take care of it. Cost price is comparatively higher than the other processes with the exception of copy-rapid papers.

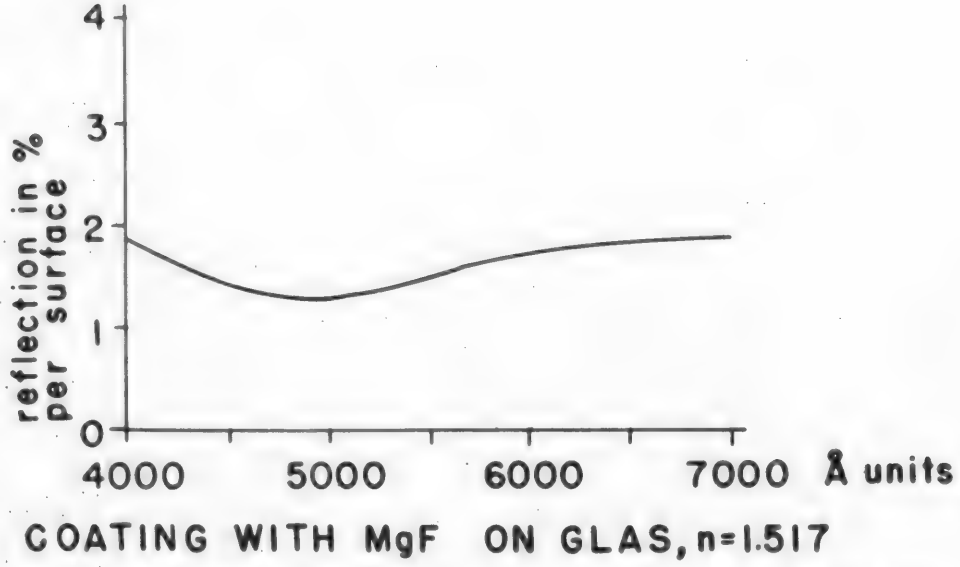
(2) Blue-printing processes are easy to handle. You do not need a darkroom; processing can be done in a dimly lighted room. Development takes just a few seconds, washing in ordinary water. A drawback is the rather long exposure time. The cost price is low, approximately one-fifth of the price of photographic paper. The record, however, is semi-permanent; it fades even when kept in a dark place. Fig. 11.

The so-called Van Dyke process is about two to three times as expensive as blue-print paper. It gives light spots on a dark brown background and has

Air to Glass Surfaces	Loss in %	Number of reflected images
2	9	1
4	17	6
6	25	15
8	32	28
10	38	45
12	44	60

Figure 7. The amount of reflection depends on the refraction index of the glass used.





Figures 8 and 9. The average coating gives least reflection between 5000 and 6000 A units.

Transmission of Quartz (Crystal)

Wave Length	1900 Å	2000 Å	2100 Å	2200 Å
Transmission in %	67	84	92	94

Figure 10. The quartz lenses are more suitable for ultraviolet photography since quartz glass transmits till 2500 Å units, and quartz crystals go even down to ± 1400 Å units.

about the same results as the blue-print papers.

(3) Diazo-type processes are positive processes, but only with a special type and much more expensive papers are you able to get reasonably good results. The price is approximately twice as high as blue-print.

(4)The copy-rapid papers are fast working and easy as well as quick to process. You obtain a negative and a positive; however, the positive is a mirror image of the paperchromatogram and you have to use different exposure times to get good results either for the positive or for the negative. The price for 1 positive and 1 negative is $.095. The record is semi-permanent.

(5) The direct-positive emulsions (Kodak direct-positive) have to be handled in a semi-darkroom. The exposure time has to be rather accurate. The processing is about three to four times as slow as a blue-print processing. The record does not fade soon; however, it is not as good as negative silver-halide emulsions and is not as sensitive. The price is slightly higher than negative silver-halide emulsions.

Only the first one has to be conducted in a photographic darkroom, whereas the other procedures can be conducted

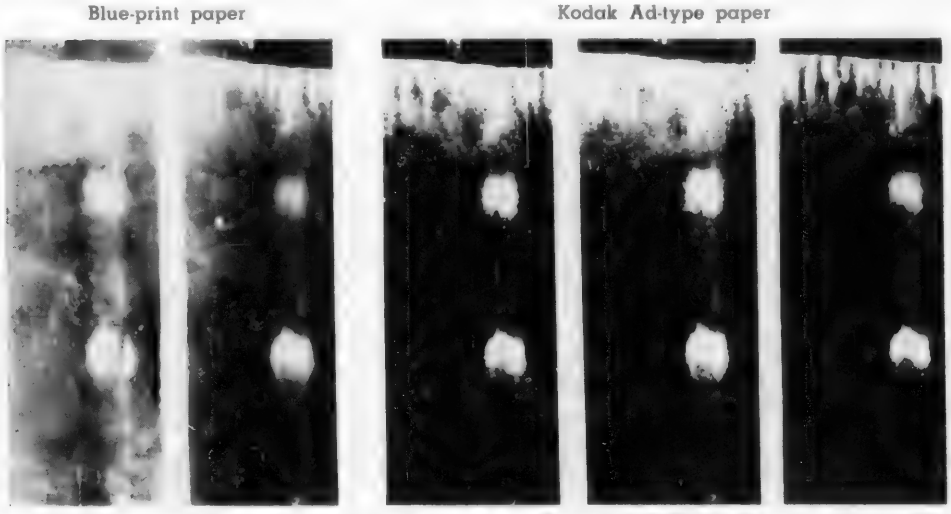


Figure 11. Combination of Blueprint and Ad-Type.

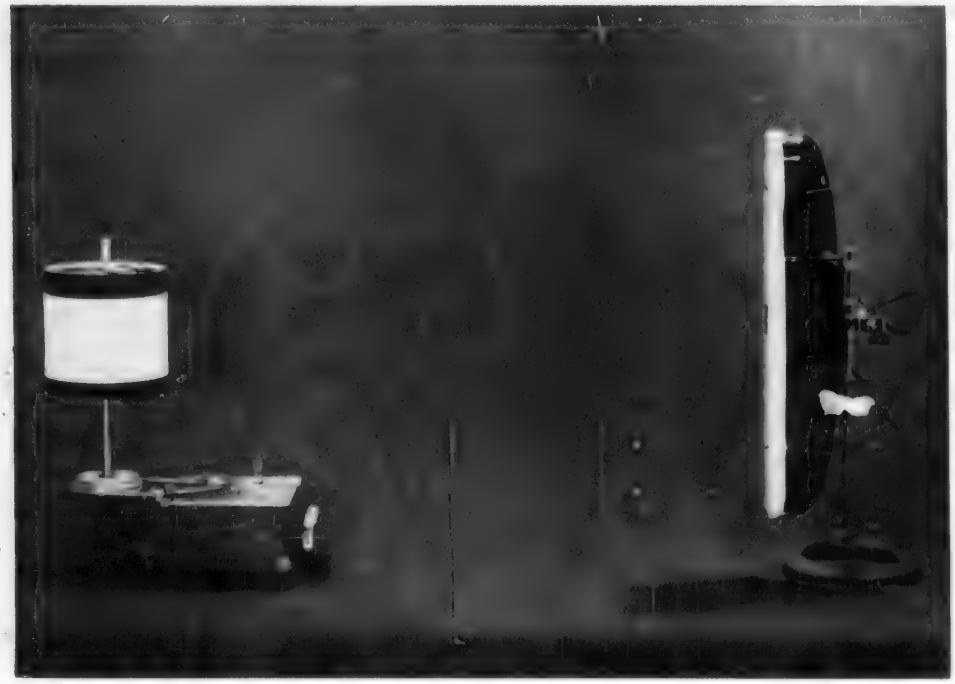


Figure 12. Set-up with U.V. Light and Rotating Drum. The main part is a rotating drum with a circumference of approximately 16 inches. We first attach the Kodak Ad-type paper around the drum with emulsion side out; on top of this we attach the paperchromatogram face up. This method assures very good contact between the paperchromatogram and the Ad-type paper. The distance between the drum and the ultraviolet lamp is approximately 33 inches.

in semi-darkrooms, subdued light, etc.

We choose the first method and use a contact printing paper which is comparatively slow but has good sensitivity in the 2400-2900 Å units range. Examples are Gevaert document contact paper, Ilford contact document #50 and #9S, and Kodak Ad-type paper, #2 and #3.

We use the latter. As developer, you can use a paper developer such as Kodak Dektol, Gevaert 251 or Clayton P-20 in the usual way. The whole procedure must be done in a darkroom with a Wratten safelight #1A or a similar filter.

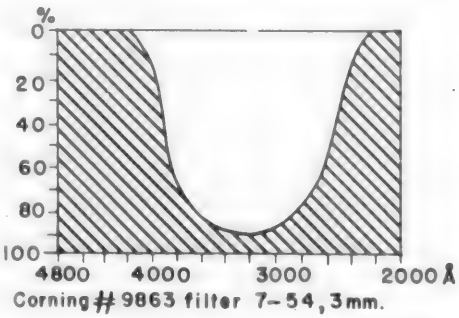


Figure 13. Corning #9863 Filter — As ultraviolet light source we use a G.E. Germicidal bulb with a Corning #9863 filter which has a 40 per cent transmission at 2540 Å units. The exposure time is found by test; the number of revolutions and the speed of the drum determines the exposure time. Because of the drum, the size of the filter can be reasonably small.

One of the difficulties is to keep the copy material and the paperchromatogram flat and in close contact with each other. You cannot use a glass plate to keep it flat with pressure. It is usually done with paper clips which are not very satisfactory. See our method, Fig. 12, 13.

Acknowledgments

I want to thank R. A. Oosterbaan, Ph.D. from the Medical Biological Laboratory of the National Defense Research Council of the T.N.O. for his generous help and cooperation as well as Mr. Becker, Bio-chemist of the Presbyterian-St. Luke's Hospital for the time and effort he spent on the project.

Summary

The behavior of U.V. light of fluorescence, and absorption, the reaction of photographic emulsions, lenses and filter with it. Application of it with chromatography to acquire permanent records which have sharp images using a rotating cylinder.

This is a brief introduction into the region of U.V. light fluorescence as well as absorption—and emission-spectra, the structural change in the atom related to light emissions; what to do and how to use, for lense filters and photographic emulsions when working with U.V. light sources; last but not least a very useful application in the field of paper chromatography.

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The Production and Use of Televisual Aids for Medical Education

RICHARD C. MATTHIAS

Medical Illustration Unit
Smith Kline & French Laboratories, Philadelphia, Pa.

MORE than thirteen years ago, in February 1947, the first successful application of television to medicine was made when Johns Hopkins University televised a surgical operation in black and white. Two years later, in June 1949, the first complete program of medical significance was presented in color by Smith Kline & French Laboratories on field sequential equipment at the American Medical Association Convention in Atlantic City. Today, black-and-white, closed-circuit television is a routine instrument widely used by medical schools and hospitals for presenting and teaching the wonders of medical science. High-definition, all-electronic, and completely compatible color TV is an accomplished fact. We have truly entered a broad, new field of scientific education.

As the use of educational television continues to increase, medical photographers and illustrators are faced with new areas of responsibility, and will become a vital part of a closely interlocked team employed to develop systems for communicating ideas. They will play an important role in the organization and production of closed-circuit programs. Of course, they won't operate the cameras or other electronic equipment, but they will be responsible for the creation of motion pictures, slides, artwork, and a variety of other televisuals. They will have to advise and help the professional people in organizing their presentations. Neither the artists nor the photographers should delay in preparing themselves for these new obligations. There is a lot to learn!

Inasmuch as television, more than any other field, requires the maximum cooperation of all those involved, televisual producers should take some interest in the "technical things" as well as the production problems. Certain peculiar requirements and general limitations of the system make it necessary to prepare visual material in a somewhat different manner than those intended for use in the usual way. Television, like a woman, is not perfect (Figure 1).

Limitations

In photography, the resolving power, of course, refers to the ability of an emulsion to distinguishably record fine detail, and is limited by the lens and emulsion. To measure resolution, a parallel-line chart with lines separated by spaces of the same width as the lines, are photographically reduced. The recorded image is microscopically examined, and the number of lines per millimeter that are just recognizable is determined. Films of low resolving

Figure 1

power resolve less than 60 lines per millimeter. By these standards, the best resolution obtainable in television is relatively poor. However, a satisfactory picture is usually obtained even though the resolution is about 48 lines per millimeter, or less than that of the best 16 mm. films, but probably comparable to a large percentage of commercial 16 mm. films. This is why TV relies on, and is enhanced by, close-ups.

Another limitation of television transmission is the loss of a portion of the picture area due to electronic cropping. Basically, it is a loss in part of the total picture broadcast. Often this electronic cropping occurs in the camera, but more often it is due to overscanning the receiver tube — resulting in a loss of as much as 7% of the broadcast picture (Figure 2).

The quality of the televised picture is further hindered by geometric scanning distortions. The scanning raster (that portion of the receiver which delineates the frame) is not geometrically rectangular in shape. Therefore, it is necessary to introduce a 10% protective border on televisuals to accommodate for this imperfection.

Even though it is possible to make out fine details on the TV screen by close examination, prolonged viewing strains the eyes. The factors which cause this eye strain — electronic soft focus, exaggerated contrast, and small

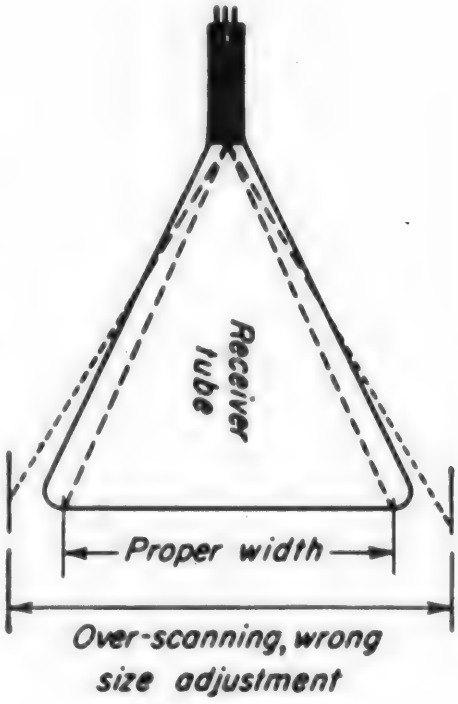

Figure 2

screen size — are the same factors which tend to confuse details.

The question of the amount of detail which can be made visible on the receiver screen is probably the most important consideration in television artwork. First of all, it determines the minimum size of lettering. It also dictates the techniques for preparing graphic material and medical drawings. Finally, it imposes certain restrictions on photography.

Standards and Procedures

In order to utilize television equipment to the best advantage, it is necessary to establish certain requirements and specifications for televisuals. Presently, every station has slightly different requirements both in the manner of preparation and the sizes of graphic material it can handle. Even though Standard Recommended Procedures have been proposed, they are in a state of flux and will remain, probably for some time, tentative. Therefore, the information which follows is intended purely as a guide and presents data which will be useful to those photographers and artists who are faced with the specialized problems of televisual production.

When any piece of graphic art is prepared for television use, it is essential to know the area on which the cameraman will frame and the inner area which is sure to be visible on every receiver screen. Still material to be televised takes several forms, each of which must be prepared to conform to a 4:3 aspect ratio (ratio of width to height). For opaque, reflection copy, an 11″ x 14″ card is an ideal size to work with. A one-inch border is allowed around the edges to take care of fingerprints or other damage which may occur in handling. This establishes a camera field (or picture area) of 9″ x 12″. A small circle, about ¼″ in diameter, is placed in each corner of this area as a framing guide for the cameraman. The information area is then determined by dividing the camera field into six equal segments and running a diagonal line from one corner of the camera field to the other. The two outer divisions become the right and left borders and the points where the diagonal intersect these establish the top and bottom of the copy area or safe area (Figure 3). This, then, is an area 6″ x 8″ centered on the 11″ x 14″ card and is 20% smaller than the camera field. To be certain that essential information is kept within the boundaries of the safe area, a simple overlay can be prepared by photographing a diagram of these divisions and printing it on a sheet of 11″ x 14″ Kodalith film.

Occasionally medical televisual-aids cannot be prepared to conform to the 4:3 aspect ratio. Whenever the subject cannot be shown by some other method, a vertical arrangement may be unavoidable. Within reasonable limits, such a visual is perfectly acceptable. To avoid problems with a vertical for-

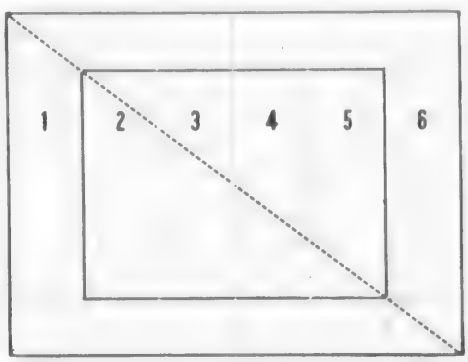

Figure 3

mat, the material should be prepared for panning. This is done by extending the top and bottom borders so each are at least 25% of the height of the panned camera field. Thus, an illustration with a camera field 12 inches wide and 15 inches high, would have a top and bottom safety border of 3¾".

Most televisuals are prepared on heavy stock, such as poster board, to withstand handling and lie flat in front of the camera. Regardless of the type of board or color used, it must have a matte surface and be neutral in color . . . white and yellow should be avoided. For purposes of standardization, an ideal board is Chicago Cardboard Company's Dawn Gray TV Board, No. 974.

Since television probably has more limitations than any other form of visual communication, several important principles, in addition to the recommended standards, should be remembered when planning televisuals. The simpler the organization of material, the more understandable and instructive it will be. Information should be restricted to a minimum with uncomplicated lettering for maximum legibility. Radical abbreviations will often help. Wherever possible, titles or headings should be eliminated. Photographs and drawings must be simple and uncluttered. Remember, the speaker will be able to reinforce his visual material with verbal commentary.

Every show uses some kind of graphic material to give a visual representation to the information presented. The simplest and most common elements are graphs and charts made up mostly of words. The lettering should be larger and bolder than is normally used on flat copy intended for other purposes. A good rule of thumb which can be used as a guide for preparing lettered charts determines that the height of letters should be a minimum of the height of chart in inches divided by 15; their width, a minimum of the width of chart in inches divided by 25. The

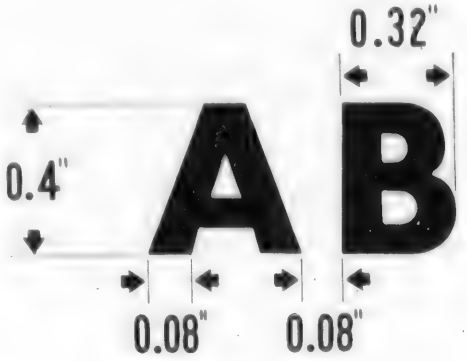

Figure 4

thickness of their stroke should be a minimum of the width of chart in inches divided by 100 with each letter or number separated by at least one stroke width. Using the 11" x 14" card as a standard, the lettering within the 6" x 8" copy area would be a minimum of 0.4" high, 0.32" wide, at least .08" in stroke width, and separated from the next letter by at least .08" (Figure 4). Lettering smaller than this will not be visible at customary viewing distances. The space between lines should be one-half the height of the letters, or a minimum of 0.2". This will allow for about 8 lines within the 6" x 8" copy area.

Of course, legibility is not a matter of size alone — the design of the letter is equally as important. It should be an aesthetically pleasing, sans-serif letter. Condensed or fancy, script lettering should be avoided. One of the best examples of a well-designed letter is

Artype No. 1158 (60 pt. Futura Medium). (Figure 5).

Lettering is an age old problem and certainly not a specialty of most medical photographers or artists, either, for that matter. Fortunately, there are a number of short cuts to good, fast lettering (Figure 6). Among these, the LeRoy Lettering Set is probably the best known, and certainly the quickest and most efficient. Several styles and techniques are possible with the wide variety of templates. Naturally, the most familiar style is that done with standard LeRoy templates and pens. The pen and template combination recommended for proper stroke thickness and letter size is a 3245-500C template and 3233-6 lettering pen. An Extended Gothic Template (No. 3241H-500C) may be substituted for the standard template to produce less stereotyped letters. LeRoy Lettering provides two other variations by using special templates to form outline letters. An Alternate Gothic Template (No. 3242-36Pc) used with a zero pen forms an outline which can be readily filled in.

Lettering for color television can be made using the same template with a Letterguide Swivel Knife. To do this, Color-Aid paper is rubber-cemented to the copy area, a layout made in pencil for proper spacing, the paper cut with the swivel knife in the scribe, and the excess removed leaving colored letters (or the reverse).

IDEAL LETTERS

ARTYPE

No. 1158

Figure 5

Figure 6

Die-cut letters, either paper or cardboard, also make fast lettering possible and, at a fairly economical rate (Figure 7). Most cutout letters are available ready-gummed in black, white, and a variety of colors and sizes. There is also a choice of colors in cardboard letters, but an adhesive must be applied to them.

Other lettering aids include pressure-sensitive Artype and transfer lettering such as Prestype and Cello-Tak. Since Artype is printed on a highly reflective acetate sheet, its direct use should be avoided. It can, however, be photographically reproduced on matte paper. With Cello-Tak and Prestype, a matte letter (and only the letter) is transferred from a supporting sheet directly to the artwork which eliminates the need for photography.

Like lettering, the lines and/or bars of graphs should be bolder than those on conventional graphs. To be easily

Figure 7

distinguishable, lines should rarely be less than 1/32" in thickness. In most cases, lines ruled with pen and ink are perfectly acceptable. There are many aids on the market today which ease the burdens of preparing statistical data. For curved lines and solid bars, ACS Tapes, Inc., feature self-adhering, non-reflecting, acetate fiber tapes in 15 colors. Zip-A-Tone color overlay sheets are now printed on matte surface acetate, making them ideal for bar graph preparation. Color-Aid paper also lends itself well to good layout and production. These materials can be used in any combination to achieve the desired effect.

Closely associated with the limitation of detail which the television medium imposes on the artist and photographer is its distortion of the gray scale. Both the lighter and darker tones are compressed. Light tones seem to all go white; dark tones tend to appear black. Tones from the central portion of the scale, however, are reproduced reasonably faithfully. The number of tones between black and white which the television system can distinguish rarely exceed seven or eight and fall within a 20 to 1 range (the human eye can clearly distinguish at least a 100 to 1 range). It is safe to say that a standardization on six tones (black, white and four grays) will result in a faithful, electronic reproduction of original art work. The black and white televisual should be composed of grays which do not harshly contrast. The range should not be too limited (results in soft art), nor should large areas of black or white be used (Figure 8).

Occasionally it may be necessary to

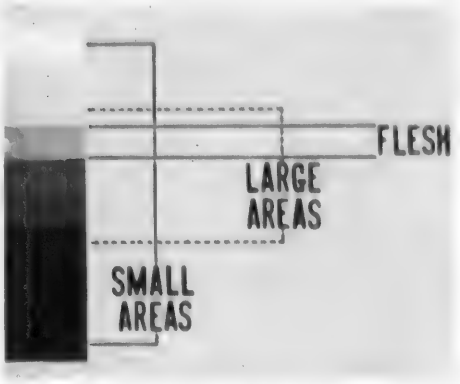

Figure 8

prepare work in color. Anyone who understands black and white TV requirements will have no trouble executing color work if he can visualize colors in terms of grays. Those artists and photographers who must work in color, even though the illustrations will be transmitted in monochrome, must be aware of the fact that the gray scale is also the main concern in determining colors for television. One system for determining the gray scale of colors, called ChromaCHron, is a palette of seven Luminal Paints made up of five colors plus black and white. This palette consists of thirteen hues (pure colors) created from the five Luminal colors.

Each hue has three tints (hue diluted with white), two tones (hue mixed with gray) and one shade (hue darkened with black). This makes a total of 91 color mixtures and a gray scale equivalent is given for each color. The use of this palette makes it possible to predict the gray equivalent of any color for black and white transmission, and yet the quality of these colors will maintain themselves when telecast in color.

Even using a ChromaCHron palette it may be difficult to look at color work and anaylze how it will look on camera. Colors can sometimes be very deceptive. The Polaroid Land Camera is an excellent way of transposing colors into a scale of gray tones, when work cannot be viewed on a monitor prior to air time.

Drawings

When the medical illustrator is called upon to prepare drawings for television, he will have to give up much of the characteristic realism normally found in medical art. The proper technique can be best described as a cross between poster art and cartooning. Like TV artwork, posters must be seen and understood at a distance, so tones and details are designed for their carrying power. Cartoons are basically simple and clear caricatures which employ simplification of line, detail and tonality. This technique lends itself better to television than do attempts to be realistic.

To illustrate anatomical relationships and surgical procedures, simple line drawings may be done in black outline with color to accent vessels and nerves. These drawings should be rendered with show card colors and brush to maintain the necessary bold lines. Whenever drawings are required to illustrate pathological conditions the artist may prefer to work in color, feeling he can portray the specimen more accurately. A free and sketchy combination of tone and line should be used with the tones leaning somewhat toward the pastels for black-and-white TV, and toward full saturation for color telecasts.

The preparation of a volume of illustrations for a scientific program is often laborious and time consuming. The ability to do things quickly with proficiency is a quality not new to a medical illustration service. A person with imagination and versatility can effectively utilize a variety of materials and techniques to complete a large series in a short time.

Mechanical paste-ups of colored-paper cutouts is an especially valuable and versatile technique, particularly if a presentation requires duplicates of a basic drawing.

The composition is prepared by rubber-cementing Color-Aid paper on the background, cutting out the drawing, and removing the unwanted area. Sketchy lines for detail and outlines separating tones can be applied with either a black pencil or a ball-point pen. The illustration is given separation from the background in the same manner. Variations of this basic technique are vitally unlimited. Three-dimensional form can be achieved by applying carbon dust to the shadow areas with a brush and white pastel to the highlight areas (Figure 9).

Interesting textures can be produced with aerosol spray paints such as Krylon (Figure 10). Overlying anatomical relations can be visualized using matte shading films to give the effect of transparent organs. An interesting way to

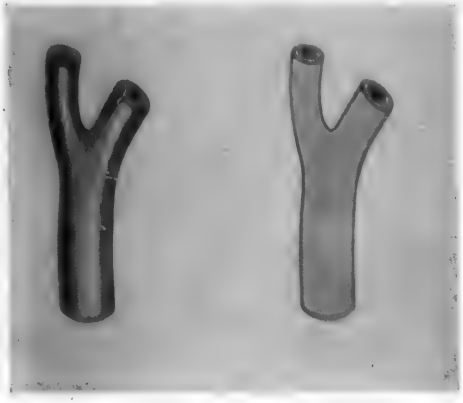

Figure 9

show diagnostic detail is with a composite – i.e., a photograph for detail and a drawing for orientation (Figure 11). Collages can create effective images for showing specialized surgical procedures – i.e., a photograph for orientation and an actual instrument for detail. Actually, there are any number of possibilities.

Presentation Devices

There are two fundamental ways of integrating static televisuals with live

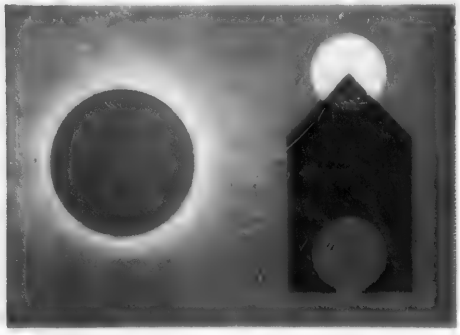

Figure 10

action, and, of course, innumerable variations within each and between the two. The first method is to support the card on an easel and show it as a static display. Some means of changing these cards in front of a single camera is the most practical way to join a series of illustrations together. Drop-in and drop-out ring binders are used as standard devices in many studios. In that both systems will exhibit irregularity of motion if the operator is not adept, the pull off is probably the simplest, most flexible and least troublesome of all changing maneuvers.

The second and more dynamic approach to handling graphic material involves developing some kind of movement that grows or animates on the screen. For example, a picture can be put together by adding elements to a flannel board. This simple, inexpensive technique lends itself well to unfolding the results of investigative findings as well as approximating anatomical relationships with sectional cutouts. Another method of injecting movement into a graphic is to rig up cutouts. The

Figure 11

growth of a graph line may be shown by sliding a panel of some contrasting shade behind the front card out of which the line has been cut. Where special effects are concerned, the only limitation seems to be imagination and ingenuity.

Photography

In selecting or preparing still photographs for television, several considerations must be kept in mind. The composition should be pleasing and the image instantly recognizable. Above all, details must be instantly distinguishable. Black-and-white prints should display a low maximum density in the shadows, be in sharp focus and not too contrasty.

Like other static visuals, the essential part of a photograph is limited to the same 6" x 8" rectangular safe area. A few minutes spent drawing an enlarging easel printing guide outlining the scanned area and usable area, will save many long hours in the darkroom.

Processing prints for TV programing necessitates minor alterations in darkroom habits. The photographer should standardize on 11" x 14" paper and process prints so they retain important detail but appear somewhat gray and flat by conventional standards. Since most medical programs are panel discussions, the studio lighting is generally a fixed arrangement to cover a broad area. Glossy prints often act like glass under these conditions, reflecting everything in sight. Therefore, matte-surface paper must be used.

The image-orthicon tube (emulsion of the TV camera) has the unfortunate tendency to retain an image that it has been held on too long, especially in the presence of extremely high contrast. Lettering often remains in the picture long after the camera has left the title. This effect can be minimized by tinting prints of high contrast material in a dilute solution of blue or green Kodak Flexichrome color. This tones the background to the high end of the gray scale, but it will still appear white on the screen.

Since photographic prints cannot be prepared on stock heavy enough to support themselves or lie flat, and, more particularly, withstand frequent handling, they must be mounted in some way before use. When used correctly, rubber cement is a good mounting method. For a solid bond, both surfaces should be covered with cement and allowed to dry before mounting. After mounting, pressure applied with a print roller will prevent a print from peeling off — usually just about air time. Probably the best method is dry mounting done in a hot press with a sheet of wax-impregnated paper sandwiched between the print and background material.

The standard slides used in television are 2 x 2's (35 mm.). Some stations are equipped to project 3¼" x 4" slides; a few can handle both. These dimensions refer to the maximum sizes, including borders, masks, mats or mounts in which the slides are placed. To ensure that there are no white borders and that no stray light will enter the camera, the actual picture area should slightly exceed the picture-background dimensions. Diagrams can be made for 2 x 2's and 3¼ x 4's delineating the overall dimension of the cover glass, the dimension of the standard slide mask opening, the area of the picture actually scanned, and the shape of the safety zone or usable area. To be certain that the essential picture infor-

mation is kept within the proper boundaries, and eliminate time consuming measurements, these diagrams can be copied and printed to the correct size on Kodalith Film, trimmed and laid over the ground glass of the camera (Figure 12).

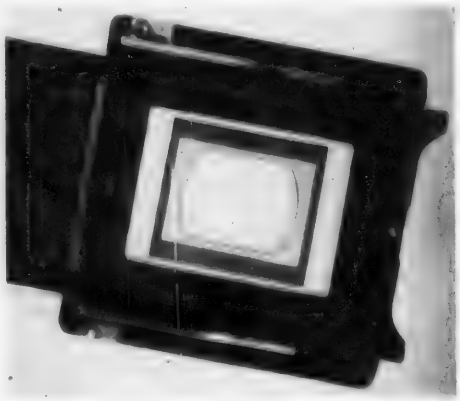

Figure 12

There is no need to discuss photographic techniques here, since the practices followed in print production apply to slide making.

The production of motion pictures for TV is substantially the same as slide production except for a few basic technical departures.

Composition of the image must be done in accordance with limitations of standards proposed by the Society of Motion Picture and Television Engineers. Basically, significant scene elements are photographed within the TV safety area. Recently, efforts have been made to have a reticle prepared for camera eyepieces.

In addition, it is preferable to use more close-ups and compose shots considerably tighter for more effectual results. Lighting must be kept at a low contrast ratio. Incident light reading meters are best for checking light sources. The ideal key-to-fill light ratio is 1:2 and should never exceed 1:4.

Projection

There are several television slide projectors in general use. Most of them accept 2" x 2" transparencies directly; 3¼" x 4" slides can be used in others. The only lens system involved in such projectors is the projector lens itself.

An inexpensive projection system can be fabricated using a standard 3¼" x 4" projector and 35 mm. projector permanently mounted side by side on a stand about 36" from a 9" x 12" Trans-Lux Rear Projection Screen (Figure 13). The image formed is picked up by a studio camera with excellent results. The 3¼ projector is fitted with an 8" lens and a 750 watt bulb; the 35 with a 6" lens and a 500 watt bulb. Since this is rear projection, the operator must take care to project the slides with the image reversed (for him).

Although most stations have specially designed equipment for showing 16 mm. films, an improvised method, similar to that described for slides, can be designed (Figure 14). The problem of synchronizing 24 frames-per-second motion picture films to the 30 frames-per-second television scanning rate is easily avoided by using a projector equipped with a TV shutter. (Exactly two frames of film must pass through the projector in one-twelfth of a second and TV shutters accomplish this by flashing one frame twice and the next three times.) An f 1.6, 2 in. lens is installed on a 750 watt projector placed 24" to 30" away from a 4½" x 6" Trans-Lux Rear-Projection Screen. The film is threaded in the normal fashion and projected

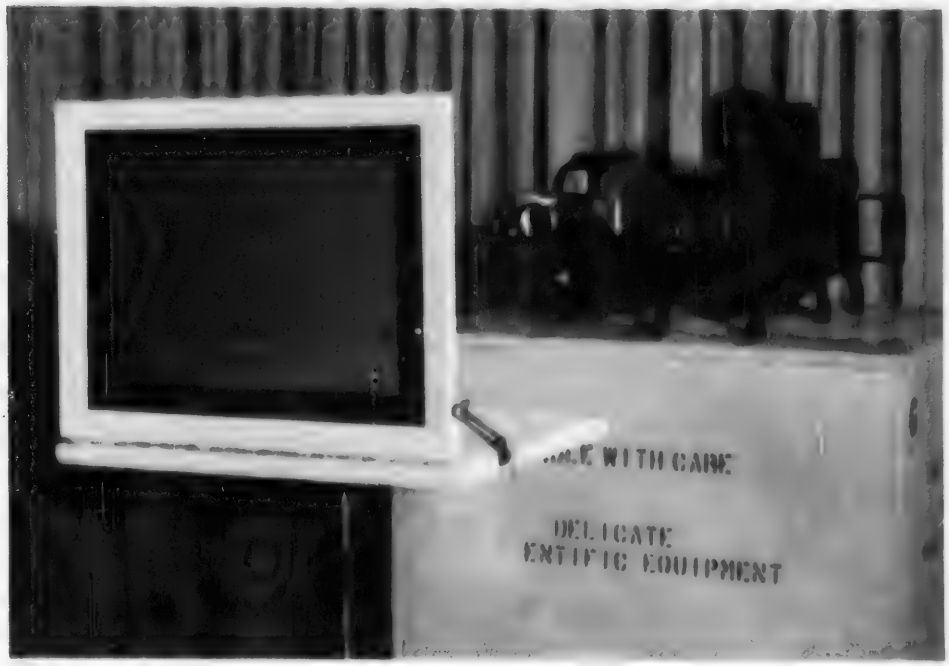

Figure 13

through a prism to reverse the image. (Reversing the film has to be avoided so sound films can be shown.) To broadcast the sound track, the audio portion is fed into the same amplifying system as the studio microphones.

Both projection stands should be positioned to prevent the studio lighting from falling on the screen. Framing the screens with a shadowbox type frame also helps.

Quite often the physician will want to point out certain details in his slides or motion pictures. An ordinary darning needle serves as an exceptionally effective pointer. Rather than using it on the camera or audience side, the pointer is used on the projector (or rear) side of the screen. This makes use of a cast shadow, instead of a semi-illuminated pointer, which cannot be lost against picture detail.

Additional Visual Suggestions

The importance of thinking of programs in visual terms cannot be over-emphasized. No matter how simple or complex a presentation is planned, it is important to think of what the audience will be hearing; but what is more important — what they will be seeing.

There have been a number of televisual techniques listed here, all of which are, in reality, adjustments from conventional illustrative and photographic methods. It is advisable to experiment with other visual forms which might contribute to the interest of a program. There are many other ways of adding to the level of interest and

visual clarity of TV demonstrations.

X-rays are frequently used during the course of case history discussions, and the original film should be used whenever possible. They are transilluminated on a standard viewbox and picked up by the studio camera. Because 14" x 17" X-rays and viewboxes (and human beings, for that matter) are a vertical format, a masking shield 19 inches wide should be added to both sides of the illuminator. This prevents the camera from picking up extraneous studio background. No matter what size X-rays are used, they should all be put in a 14" x 17" mask with an opening ½" smaller (in each direction) than the film. Large color transparencies can also be used by masking them in a similar manner.

Patients can add to the visual interest of a program, particularly when they visually demonstrate some disease or disorder. Some orthopedic clinics have effectively used models to demonstrate bone setting and casting techniques.

Children's toys have frequently been used with interesting results. During a clinic on heart disease, a physician used toy soldiers in groups which he knocked down to illustrate mortality rates.

Small artist's manikins with moveable joints can be used to create physical deformities or show surgical posi-

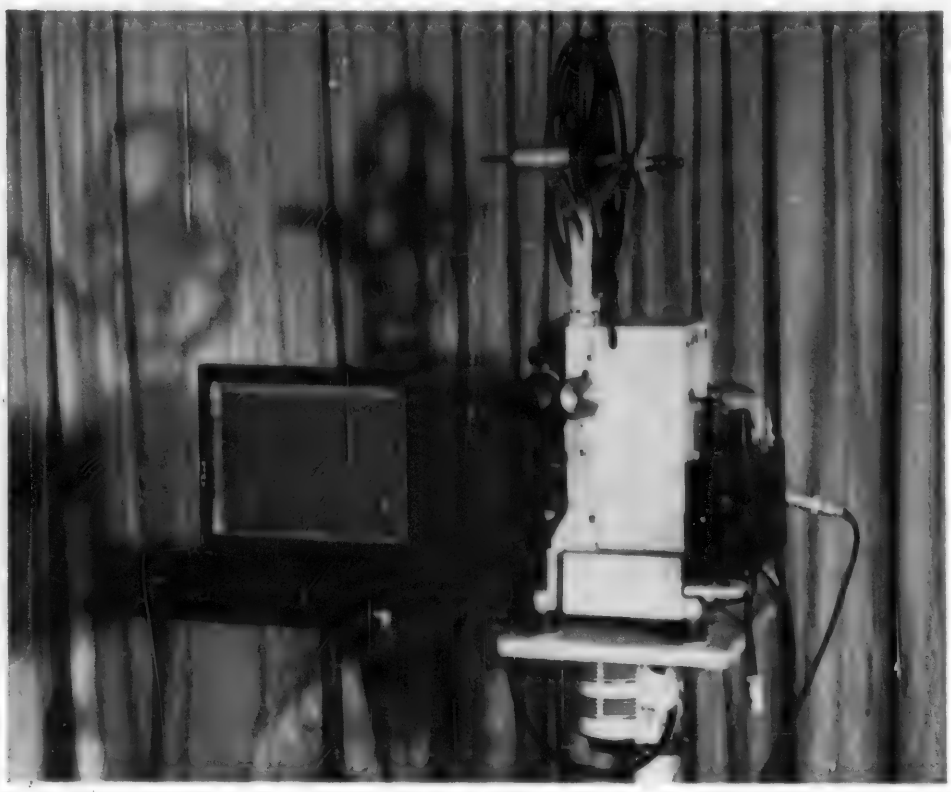

Figure 14

tioning of the patient. The audience can be acquainted with anatomical relationships on three-dimensional models available in most anatomy departments.

Any type of equipment, instrument or machine will add interest to detailed descriptions. Instruments and equipment with highly reflective surfaces should be dulled to wipe out "burn" reflections that cause blind spots. Krylon, Inc. markets an excellent product which is perfect for this purpose. It is a semi-drying, dulling spray in a pressurized dispenser that can be quickly applied and removed with a soft, dry cloth at the close of the program with no ill effect to the object.

Of course, live surgery and actual specimens are telecast extensively in black-and-white, although color TV is more meaningful. Like color photography, light green or blue drapes should be used around the surgical site. Sterile bone wax is effective for dulling highly reflective instruments, if the surgical suite is not equipped with "glareproof" instruments.

Conclusion

Most every closed-circuit medical television program is an everyday problem of medical practice, skillfully presented, that the audience finds absorbing. Patients, specimens, external signs of disease, internal corrective procedures and scientific apparatus can be seen close-up. But the attention of the audience is concentrated on a relatively limited field. This makes the problem of maintaining interest a tough job for the visual communication specialist. The constantly increasing use of the medium has created new concepts in the field of audio-visual communications and offers new challenges to the medical photographer and medical illustrator. Remember, the physician wants to learn something he can take home and use; to do this, he must be able to see what he's being taught.

REFERENCES

1. Bretz, R. Techniques of Television Production, McGraw-Hill Book Co., N.Y. (1953)
2. Warren, F. Television in Medical Education, An Illustrated Handbook, American Medical Association (1955).
3. ChromaChron, ca, The Journal of Commercial Art, March 1960

Chevalier L. Jackson, M.D., was an active physician-photographer member of the Biological Photographic Association. After receiving his medical degree from the University of Pennsylvania in 1926 he entered the specialty of Bronchoesophagology and Laryngeal Surgery developed through the monumental work and teaching of Chevalier Jackson, Senior. Never satisfied to accept the position of the son of a famous father, he became internationally recognized for his medical and photographic achievements. As Professor and Head of the Department in his specialty at Temple University in Philadelphia, he made outstanding contributions to clinical and anatomical aspects of laryngology and bronchoesophagology. He pioneered in the use of audiovisual teaching material in the many courses in endoscopy he was invited to conduct in North and South America and in Europe. He was the first to correlate laryngeal photography with a sound

track of the phonating larynx and used this for research, teaching and therapy. Surgical and particularly endoscopic photography had received much of his attention and this led to the production of an outstanding film on bronchial anatomy.

Dr. Jackson's love of music and especially of opera was expressed with the same intensity that characterized his medical life. He was President of the Philadelphia Grand Opera Company and for this, as well as his internationally recognized medical contributions, he was honored and esteemed by his fellow Philadelphians and his medical and photographic colleagues throughout the world. He was a Chevalier of the Legion of Honor of France, a Commander of the Order of the Liberator San Martin (Argentina) and an honorary member of the Faculties of Medicine of numerous Universities. His membership in many international medical and photographic societies included the Societe Medicale Internationale de Photo Cinematographic et Television Endoscopiques et de Radiocinematographie (Paris) and he was Secretary of its First International Congress in New York in 1957.

Dr. Jackson's loss will be felt in photographic as well as medical circles in both of which his enthusiasm, vision, and new ideas contributed so much.

PAUL H. HOLINGER, M.D.

Dr. E. J. Farris is Dead at 53

Past President Biological Photographic Association

Dr. Edmond J. Farris, former executive director of the Wistar Institute and head of the Farris Institute for Parenthood, died Thursday, April 13, in his office at 133 S. 36th st. He was 53 and lived at 329 Bala av., Bala-Cynwyd.

Dr. Farris, known for his accomplishments in the field of fertility, was graduated from the University of Buffalo and received his Ph.D. at the University of Pennsylvania.

He was a former member of the faculties of the Medical College of South Carolina, the University of Buffalo, the University of Michigan and Georgetown University. He was a research associate of the American Museum of Natural History.

Lectured at Penn

Dr. Farris lectured on his sterility studies at the Graduate School of Medicine at the University of Pennsylvania. He was executive director and an associate member of the Wistar Institute of Anatomy and Biology from 1936 to 1958 when he left to organize the Farris Institute.

The Farris Institute workers perform research in conception timing which has opened new fields in the alleviation of sterility.

Dr. Farris was recipient of an award by the National Research Foundation for the Alleviation of Sterility, the award of the American Urological Association and a citation from the University of Buffalo for distinguished accomplishments in medical research.

Found Emotion Guide

While with the Wistar Institute, Dr. Farris discovered a technique for gauging hidden emotions by lymphocyte count on one of the five varieties of white blood cells.

Dr. Farris was an honorary member of the Obstetrical and Gynecological Societies of Panama and Brazil. He was a former president of the Biological Photographic Association and a member of the American Association of Anatomists, the American Society for the Study of Sterility, the International Association of Medical Museums, the Physiological Society of Philadelphia, the American Society of Anthropologists, the Endocrine Society of Philadelphia, the American Association for the Advancement of Science and the New York Academy of Sciences.

Headed Fraternity

He was a former president of Sigma Xi research fraternity and a member of Phi Beta Kappa national scholastic honor society. He was a Mason.

He is survived by his wife, Louise; a son, Edmond, Jr.; two daughters, Louise and Suzanne, and two brothers.

Report from Europe

STEPHEN P. DITTMAN

In the Fall of 1960 a number of BPA members visited Europe, particularly Germany, in connection with a medical photographic meeting and related activities. Undoubtedly, the most outstanding event attended was the First International Congress on Medical Photography and Cinematography held at Dusseldorf, Germany, from 27 to 30 September. At that same time in Cologne, a picturesque city some 25 miles down the historic Rhine River from Dusseldorf, "Photokina" took place. There were also BPA members present at the General Assembly of the World Medical Association held in West Berlin from 15-22 September and they later visited the US Army's European medical illustration unit at Landstuhl, Germany.

The medical photo Congress in Dusseldorf, first of its kind, brought together 800 delegates from 25 countries. Concurrent meetings were held in adjacent lecture halls. Papers and demonstrations were presented in English, French and German with excellent simultaneous translation available to all conferees by means of individual radio head sets. Eighty-one motion pictures were shown continuously throughout the meeting in a separate film theatre. Numerous scientific exhibits vividly illustrated techniques from all parts of the world. There were very few commercial displays since "Photokina", described as the world's largest photo fair, contained the photo and audiovisual products of some 5500 companies from 18 countries. This mammoth display took the better part of one day to see only the surface.

Since photography was the theme of this European visit perhaps the photo montages on the next pages will best illustrate the highlight activities of this report. Beginning with Figure 1, Mr. Charles E. Engel, FRPS, FBPA, head of the Department of Medical Illustration, Guy's Hospital Medical School, London, spoke on "Television in Medicine" and on "Photomacrography". Figure 2, Dr. Kenneth S. Tydings, New York, spoke on "A New Era in 8mm Medical Cinematography". Figure 3, Mr. F. D. Wallace, Head, Medical Illustration Service, VA Hospital, Lexington, Kentucky, talked on "Devices & Techniques used in Cinematography of Neuropsychiatric Patients". Mr. Wallace also visited several psychiatric facilities throughout Europe. Figure 4, Mr. Ralph P. Creer, FBPA, Director, AMA Department of Medical Motion Picture and Television, Chicago, talked on the Production and Utilization of Medical Films in the USA.

He was responsible for the film production program at the general assembly of the World Medical Association held in Berlin and also visited other cities in Europe, including London, where he met with British medical illustrators. Figure 5, Meeting room. Figure 6, Creer, Ikenberg, Dittman, Gibson, Hodge and Julin visit "Photokina" with Dr. Hansell, center. Figure 7, Gibson and Creer are being instructed by Miss R. Friebel of Cologne in the use of the simultaneous language translating device. Lou Gibson of Kodak visited many Kodak facilities and leading hospitals in Europe. He lectured in London to the British medical illustration group and also visited his family and scenes of his boyhood in England. Figure 8, International group of BPA members are seen here enjoying some of the good and colorful German nightlife in Dusseldorf.

Figure 9, Julin, Dittmann and Ikenberg at the Congress banquet with officials of the Congress. Figure 10, Mr. Gottlieb L. Schneebeli, College of Medicine, University of Utah presented "A Microcinematographic Method for the Evaluation of Steriod Hormone Effects on Leukemic Lymphocytes". Figure 11, Mr. Gerard M. Lindley, New York, read a paper entitled "Medical Photography in Africa" by Bensusan and Shewitz. Figure 12, Dr. Peter Hansell, FRPS, FBPA, Director of Medical Illustration, Westminster Medical School, London, presented papers on Standardization in Routine Clinical Photography and on Photokeratography. Figure 13, Capt. Stephen P. Dittmann, MSC, FBPA, Commanding Officer, 26th Medical Detachment (Illustration), US Army, Landstuhl, Germany, addressed the Congress at its formal banquet and presented two scientific exhibits produced by unit. Figure 14, The BPA group visits with Professor H. Schober of Munich, President of the Congress. From left to right, Charles P. Hodge, FBPA, Head Medical Photo Section, Montreal Neurological Institute, Canada, Dittmann, Maria Ikenberg, FBPA, Head, Medical Photo Section, College of Medicine, University of Illinois, Professor Schober, Leonard A. Julin, FBPA Head, Medical Photo Section, Mayo Clinic, Creer, H. Lou Gibson, FBPA, Eastman Kodak Company and Lindley. Figure 15, Leonard Julin, official BPA representative, discussed the Status of Medical Photography in the United States. He also attended the World Medical Association meeting in Berlin. Figure 16, BPA members visit with Capt. Dittmann at the 26th Medical Detachment (Illustration) Landstuhl, Germany. This unit provides a variety of medical training aids and audiovisual devices for all US Army medical installations in Europe. Figure 17, Maria Ikenberg receiving her award. Mrs. Ikenberg presented a paper by Dr. P. H. Holinger and herself on endoscopic photography in Otolaryngology and Bronchoesophagology. Figure 18, Exterior view of the buildings. Figure 19, BPAers pause during their photographic tour along the picturesque Rhine River. On the extreme right is Herr Heinz Weichert of the 26th Medical Illustration Detachment who was

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responsible for these photographs. Other BPA members present at the Congress included Ella Breckenridge, George Pontafax, Hans Domanish and Nils Nilsson.

There seemed to be no question among our traveling BPA members as to the enjoyment, information and value gained by each during this visit to Europe. They all look forward to the possibility of attending the next International Congress in Medical photography which is scheduled to be held in 1963 in London. The 3rd Congress is tentatively planned for Rochester, New York.

Auf Wiedersehen

COUNCIL ON MEDICAL TELEVISION

of the

Institute for Advancement of Medical Communication

33 East 68th Street, New York 21, N. Y.

The February 1961 issue of *Conference*, published by the Science Information Bureau in New York, contains a transcript of a discussion on "Television in Postgraduate Medical Education". This symposium was arranged in cooperation with the Council On Medical Television, an activity of the Institute for Advancement of Medical Communication, and covers pedagogic and financial problems together with thoughts concerning the limitations and potentials of both open-circuit and scrambled-image TV transmission. Copies can be obtained, at no cost, by writing the Council at 33 East 68th Street, New York 21, N. Y.

JOHN K. MACKENZIE
Executive Secretary

Father and Son Team of Doctors Ira A. Abrahamson's Sr. & Jr. were awarded the Gold Medal for their teaching exhibit on eye ailments at the Ohio State Medical Association's annual meeting, held in Cincinnati April 10th through 13th, 1961.

The exhibit consisted of over 200 color slides showing eye diseases, underneath of each slide a flap covering the correct clinical diagnosis. Viewers were invited to diagnose each and then ascertain if their guess was correct, by lifting up the flap, to read the correct diagnosis.

Also exhibited were several dozen 8 x 20 Kodachrome enlargements, of anterior segment ocular diseases.

BOOK REVIEWS

INSECT LIFE AND INSECT NATURAL HISTORY, *by S. W. Frost, second edition, 524 pp., Paperbound $2.25, Dover Publications, Inc., New York.*

This very interesting book is a middle-level account of the immense empire of insects by one of the nation's foremost entomologists. It is pleasingly presented and should appeal to the browser, the student, and anyone who has ever been fascinated by the most abundant creatures in the animal kingdom. It contains extensive bibliographies, and its 700 illustrations are clearly presented. A scholarly, well organized book.

L. C. M.

SECTION CUTTING IN MICROSCOPY, *by H. F. Steedman, C. C. Thomas, Springfield, Ill., (1960), $5.50, vii+172 pp., cloth bound.*

Few materials can be examined with the microscope without special preparation; in biology and medicine this usually means cutting thin sections from the specimen. Now a book devoted to this technic has appeared. Part 1 is a brief history of the subject. Part 2 considers the constituents of living cells and how best to preserve them, discusses hardness of the tissues, changes from fixation, the properties needed in an embedding medium, and the cost of equipment and training. The author's statement that " . . . microtomists are made efficient only after some years of experience and training" should be noted well by both the student and Laboratory Director! Part 3 discusses the properties and use of paraffin, celloidin, water soluble embedding media, double embedding, ultrathin sectioning; microtomes and knives (including sharpening), time schedules and difficult objects, provides a glossary, short bibliography, a list of suppliers, and an index.

This is a British book and a few differences of expression and use will be noted. Suppliers, although very few, are included from the United States. Almost every page reflects the thirty years' experience of the author. It is a practical handbook. Careful reading will save the beginner much loss of time and material and the oldsters can get a good review and information on the newer embedding materials.

Oscar W. Richards

HOW TO KNOW THE FERNS, *by Frances Theodore Parsons, second edition, 215 pp., Paperbound $1.25, Dover Publications, Inc., New York.*

This book is a guide to the names, haunts, and habits of the vast and relatively unappreciated world of North American ferns. Ferns tend to be overlooked by nature-students, although they are among the most beautiful and abundant of native American plants. It contains an introduction to the 57 most important ferns found in the United States, with a simple identification key and a botanical description of each fern. This book can be used by any nature lover, no previous knowledge of botany is necessary.

NEW MEMBERS THROUGH APRIL 30, 1961

CALIFORNIA: *Angwin*, Lloyd E. Eighme, P.O. Box 4. *Berkeley*, Gardiner Trowbridge, II, 2694 Hilgard Ave. *Long Beach*, Hubert A. McClain, 3559 Lemon Ave. *Long Beach*, Dr. Allan E. Ward, 324, Newport Ave. *Los Altos*, Herman Adler, 368 Gordon Way. *Los Angeles*, Leonard Apt, M.D., 11670 Sunset Blvd. *Los Angeles*, Leo Kaplan, M.D., Mt. Sinai Hospital. *Oceanside*, Charles G. Bratenahl, U. S. Naval Hospital. *San Francisco*, Francis Downie, 2135 Grove. *San Francisco*, Ray W. Guenther, 110 Edgewood Ave. *San Francisco*, Norman L. Keeve, Galilee High School. *San Francisco*, Ernst A. Schwarz, Mt. Zion Hospital.

CONNECTICUT: *Groton*, Miss Nancy W. White, Chas. Pfizer & Co., Inc., Pathology Dept., Medical Research Labs.

DISTRICT OF COLUMBIA: *Washington*, Miss Luvenia C. Miller, Walter Reed Medical Center Armed Forces Institute of Pathology.

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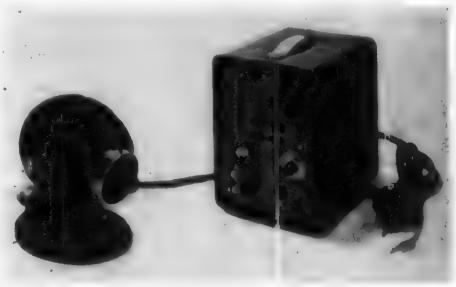

NEW ELECTRONIC FLASH ILLUMINATOR FOR MACROPHOTOGRAPHY AND PHOTOMICROGRAPHY

Designed for use in making extreme close ups of small and microscopic subjects, a new electronic flash illuminator using a small xenon-filled flash lamp has been developed by Edgerton, Germeshausen & Grier, Inc., Boston, Mass. It has been used successfully in applications ranging from photography of blood vessels in the white of the eye to photography of insects.

With its highly concentrated light beam, the new flash illuminator has proved highly effective in the field of photomicrography and shows real promise for close-up photography of rapidly moving subjects in color or black and white.

Light from the lamp can be imaged on the subject by a conventional condensing lens or by direct radiation from the lamp held in a special, glass-insulated holder. A tungsten lamp of variable intensity located near the xenon flash lamp permits optical line-up and focusing.

Specifications:

Input to Lamp	— 100 watt-seconds (capacitance 250 mfd, voltage 900) Efficiency 2 bcp/watt
Flash Duration	— 150 microseconds with 100 w-s input
Source Size	— 4 mm x 1.5 inches
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Focus	— Tungsten lamp with adjustable output
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For further information, write or call Applications Engineering Dept., Edgerton, Germeshausen & Grier, Inc., 160 Brookline Avenue, Boston 15, Mass.

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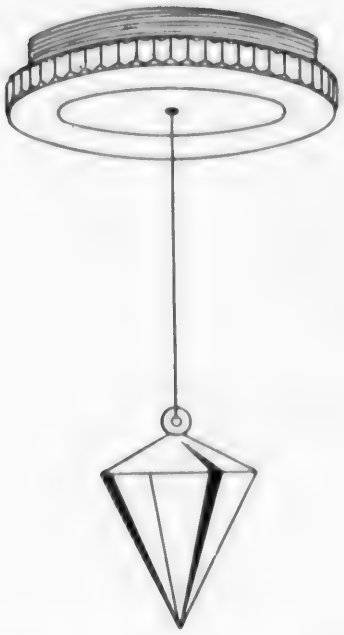

FOOLPROOF CENTERING DEVICE FOR CLOSEUPS NOW AVAILABLE FOR ALL CAMERAS

Designed to fit a standard filterholder, the Accura Proxi-Centre takes the guess work out of closeup photography for cameras without through-the-lens viewing.

Priced at $3.95, the Proxi-Centre is a threaded disc, available in Series V, VI and VII sizes. A plummet attached to a line from the center of the disc is lowered to the subject marking the exact center.

Well suited for 35mm rangefinder, folding and Polaroid Land cameras, the Proxi-Centre provides greater accuracy with twinlens reflex cameras than any other parallax-correcting device.

An import of the Photographic Importing & Distributing Corp., 135-06 Northern Blvd., Flushing 54, New York.

FIRST WIDE ANGLE LENS FOR TWIN-LENS REFLEX IS NOW AVAILABLE

The first and only wide angle lens ever made for a twin-lens reflex camera — the 65mm f3.5 — is now being delivered. Long awaited by professionals and amateurs alike, the 65mm increases the Mamiya line of interchangeable lenses to five — the normal 80mm f3.5 and three telephotos: 105mm f3.5, 135mm f4.5 and the 180mm f4.5.

When originally introduced, the Mamiya C2 was the first Twin-Lens Reflex to offer the ease and convenience of interchangeable lenses. Today, with a number of interchangeable lenses added since its introduction, the Mamiya C2 is still the only Twin-Lens Reflex to provide this major advantage.

The new wide angle, like all Mamiya Twin-Lens Reflex interchangeable lenses, is provided with an optically matched viewing lens. Extremely sharp from edge to edge, with a minimum of vignetting or curvature distortion, the 65mm is mounted with a flash-synchro shutter that can be used for M-X synchronization at speeds from 1 to 1/500th of a second. It focuses from 3⅝" to infinity, has 6 elements and has a 68° field of view.

Another unique Mamiya C2 accessory recently introduced is the Porroflex Image Erecting Eyelevel Finder. The Porroflex offers all of the advantages of a prism unit at far less cost. Cost for the Mamiya Wide Angle 65mm is $149.50.

ZEISS IKON'S GENERAL SALES MANAGER HAILS RETURN OF U.S. AGENCY TO ORIGINAL OWNERSHIP

New York — On a recent visit to the offices of Camera Industries of West Germany here, Mr. Carsten Th. Dubber, general sales manager and member of the board of directors of Zeiss Ikon A.G., Stuttgart, announced the return of his company's exclusive U.S. distributing agency, Carl Zeiss, Inc., New York, to German ownership — the Carl Zeiss Foundation, Heidenheim-an-der-Brenz.

Mr. Dubber remarked that despite the fact that Carl Zeiss Inc., had operated under the direction of the United States Government for many years, a steady improvement of the company's sales efforts had been achieved.

Now that the transfer back to the original owners has been accomplished, he stated that Zeiss Ikon is ready to sell its still-camera and movie equipment with renewed vigor, utilizing new sales ideas and advertising techniques that are particularly designed to meet today's requirements in the United States market.

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Superior craftsmanship in still or motion picture photography of biological subjects.

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(These require submission of evidence.)

Meritorious contributions to biological photography overall through sustained organizational work.

Two sponsors are required. The sponsors should be well acquainted with the candidate's work and ready to furnish the Board with details of his experience and achievements. Those who wish to sponsor a member whom they believe to be eligible should request a Fellowship Application form from the Secretary of the Fellowship Committee: Mrs. Maria Ikenberg, University of Illinois, 904 W. Adams Street, Chicago 7, Illinois.

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Dedicated to the Science, Techniques and Applications Pertaining to the Photography of All Things Which Live or Which Have Lived

QUARTERLY OF THE BIOLOGICAL PHOTOGRAPHIC ASSOCIATION, INC.

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Journal of the Biological Photographic Association Vol. 29, No. 3 August, 1961

An Electronic Flash Adaptor for Photomicrography*

JOHN J. LEE

Department of Micropaleontology
American Museum of Natural History, and Haskins Laboratories

BERNARD FRIEDMAN

Kramer Scientific Corporation

A RESEARCH microscope occupies an important place in almost every protozoological laboratory. Isolation of many protozoa in axenic culture for nutritional and biochemical studies creates a need to know the taxonomy of these isolates. Good photographs of some types of living protozoa, particularly small flagellates, are difficult to take; their small size, often requiring high magnification and phase-contrast microscopy for detailed study of critical taxonomic characteristics, along with their rapid movement, creates a contradictory photographic problem — relatively low light intensity and high-speed photography.

The available solutions to these problems have serious shortcomings. High-speed emulsions are useful but have undesirable grain size and are slower than the microscopist requires. High-intensity light sources often injure living specimens. Many photomicrographers have, for the same or similar reasons, concluded that the most promising recourse is to adapt the electronic flash to the microscope. The electronic flash provides high intensity light of brief duration (1/500-1/5,000 second) and excellent color-temperature characteristics close to that of daylight.

Traber[1] placed the flash tube immediately below the microscope condenser. This procedure has the advantage of simplicity, but unfortunately forms an image of the light source too close to the object plane, which results in unevenness of illumination. Leitz uses the same system but overcomes the difficulty by using the Berek 2-diaphragm bright-field condenser so that the flash tube is situated in front of the field diaphragm.

Lonert[2] used a conventional photographer's strobe unit in front of a field lens and diaphragm. He directed the beam of a microscope lamp into the reflector of the flash for observation. This method does not permit critical observation of the specimen before making the exposure.

Michel[3] devised a method of flash illumination for microscopes having built-in illumination. His method has the advantage of permitting critical observation up to the moment of exposure. Both the built-in lamp and the external flash provide Köhler illumination. A specially designed beam-splitting mirror

* The equipment described was bought with the support of N.S.F. grant G-10743. The flagellates in Figs. 1-7 are from the culture collection of Dr. J. J. A. McLaughlin, Haskins Laboratories. Figs. 8 & 9 were taken by Mr. A. Puschi, Fig. 2 by Mr. J. C. Prager.

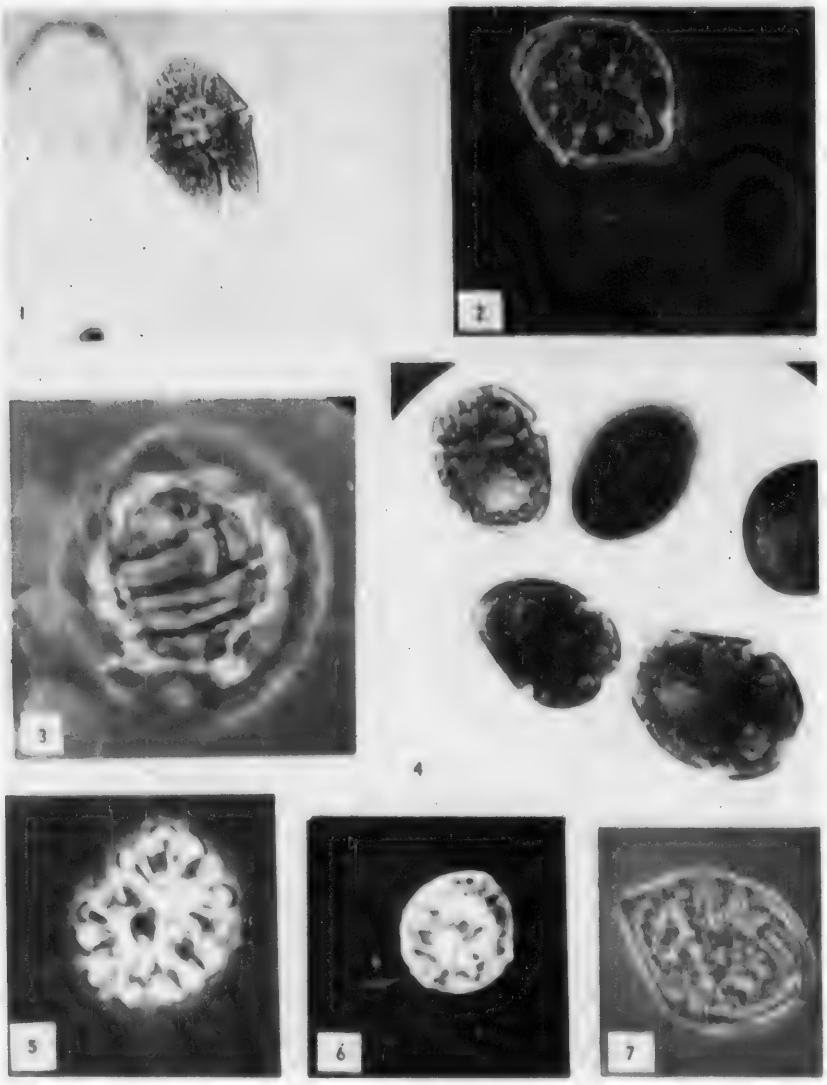

Figure 1. *Gymnodinium* sp.

Figures 2 & 6. *Glenodinium foliaceum*

Figure 3. *Gonyaulax* sp.

Figure 4. *Katodinium dorsalosulcum*

Figure 5. *Synura* sp.

Figure 7. *Peridinium trochoideum*

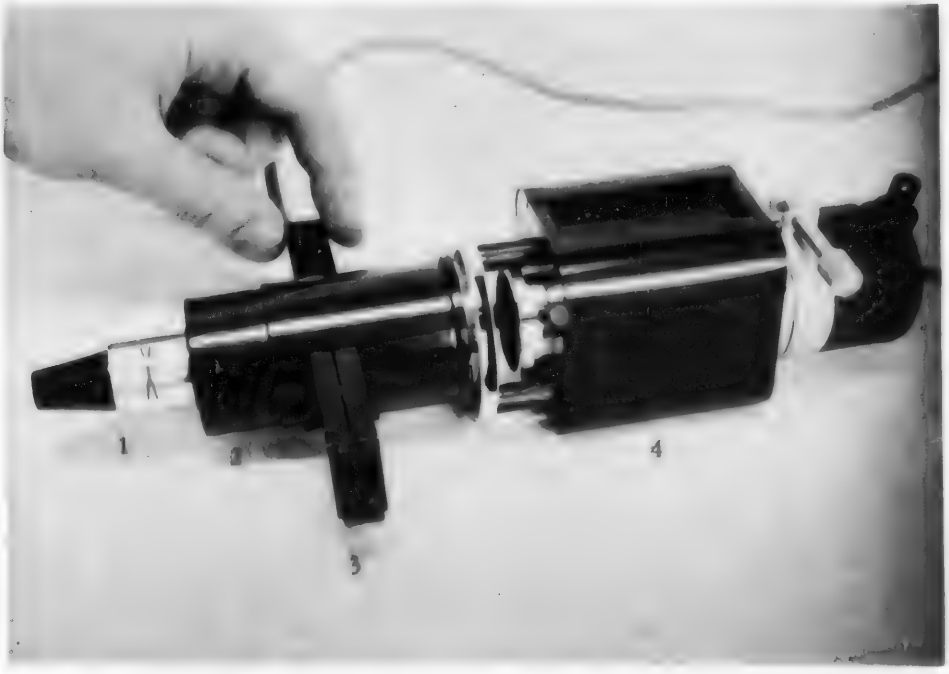

Figure 8. The electronic flash adaptor.

1. Zeiss external light collector.
2. Connecting tube and flash-tube holder.
3. Leitz multiblitz-micro flash unit in place.
4. Leitz Ortholux illuminator.

permits light to pass through for observation, and reflects the flash into the optical system.

Smith and Nevala[4] designed a versatile flash illuminator employing a flash tube with a small discharge gap. The coiled tungsten filament of a low-voltage microscope lamp forms an image in the spark gap, and provides adequate illumination for visual work. Although this unit is not available commercially, detailed instructions for construction are given in their paper.

Our system was designed to incorporate the best features of former designs in a Carl Zeiss Jena Lumipan microscope with built-in illumination. This microscope was selected because it has a substage having a triple condenser turret with a pancratic system, an apla-

EXPLANATION OF PLATES

Figures 1 & 4 were taken with a Zeiss 20X N.A. 0.65 apochromatic bright field objective at a total original magnification of 300X. Exposure was 150 WS (joules) with a Leitz neutral density filter No. 2. Figures 2, 3, & 7 were taken with a Zeiss 40X N.A. 0.65 phase objective at an original magnification of 400X. Exposure was 300 WS. Figure 5 was taken with a Zeiss 90X N.A. 1.25 oil immersion phase objective at a total original magnification of 630X. Exposure was 300 WS. Figure 6 was taken in dark-field illumination with a Zeiss 60X N.A. 1.0 oil-immersion apochromatic objective with an iris diaphragm at a total original magnification of 300X. Exposure was 300 WS.

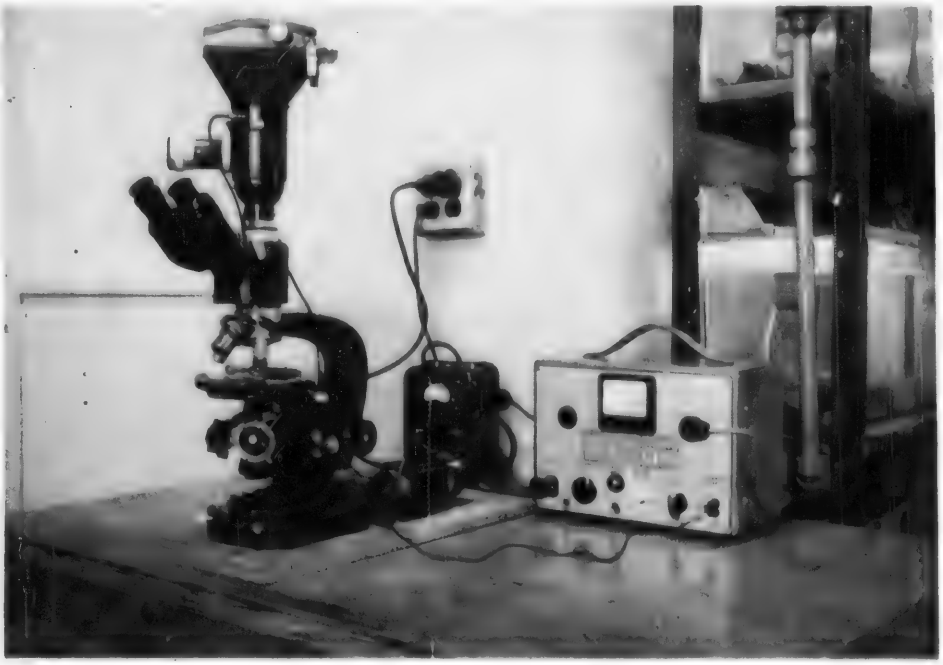

Figure. 9. The flash unit in position on the microscope.

natic 1.40 N.A. condenser, and a cardioid dark-field condenser. The rapid and convenient change-over from bright-field to phase-contrast or dark-field is an advantage. In addition, polarization accessories are easily added to the optical system.

The Leitz Multiblitz micro electronic flash unit was selected because it contains an evenly illuminated, flat, transparent discharge tube which if properly placed, does not obstruct the secondary illumination. Flash durations, 1/1,000 of a second, are delivered by the power unit. Neutral-density filters and a 2-position power unit, capable of delivering either 150 or 300 WS, enable the user to obtain a graded series of flash intensities.

In our adapter the flash unit is placed between the Köhler stop of the microscope and the secondary illuminator. Köhler illumination for critical observation is possible up to and including the moment of exposure. If exposures are made at 1/125 sec. or faster, the effect of the light obtained from the secondary illuminator is negligible. Consequently, adjustment of background intensity is not necessary to take a picture.

An adapter was designed (Fig. 8) to accommodate the Leitz Multiblitz micro flash tube. It consists of a Zeiss external light-collector, a Leitz 30-W low-voltage Ortholux microscope lamp, and a tube connecting both. This tube is slotted to hold the flash tube and has an adjustable stop for centering. The entire unit is placed in the base of the microscope in place of the usual lamp-holder.

Figures 1-4 show the effectiveness of

the apparatus in catching fast-moving flagellates on a fine-grain film. All photographs were taken with Kodak Panatomic-X film, and developed with either F R X-22 or Kodak D-76 and printed on Kodabromide F-5 paper. Good exposures can be obtained with bright-field, phase-contrast, polarized light or dark-field. Excellent results have been obtained with daylight color films.

BIBLIOGRAPHY

1. Traber, H. A. *Die Anwendung der Elektronenblitzgerate in der naturwissenschaftlichen* Dokumentarphotographie. Naturw. Rdsch.: 4: 144-147, 1952.
2. Lonett, A. C.: *Electron flash illumination for photomicrography.* Turtox News 32: 8-12, 1954.
3. Michel, K. *The use of the electronic flashlight in photomicrography.* Photographie und Forschung 5: 140-148, 1953.
4. Smith, B. F. and Nevala, L. *A variable output electronic point light source for photomicrography.* J. Biol. Phot. Assoc. 24: 63-69, 1956.

NOTICE

Recently, our Insurance Administrators -- the Joseph K. Dennis Company - advised the Insurance Committee that the underwriters of our group policies would be cancelled on September 1st unless we could secure a minimum of fifty additional acceptable applications for each of the two policies within a few weeks. The membership was immediately advised by mail.

The company has paid losses to date considerably in excess of premiums and the only solution is greater participation on the part of our members.

The BPA Health, Accident and Income Insurance made available to our members and their associates is the best insurance buy today and the Committee is unable to understand the reluctance of BPA members to take advantage of this low cost protection which was made available after a long period of investigation and negotiation.

This protection can mean a great deal in case of accident or illness as evidenced by the unsolicited letter from our own Jane during her recent illness.

MARIA IKENBERG, *Chairman*
Insurance Committee

MEDICAL PHOTOGRAPHER

To be in charge of all photographic work for the School of Veterinary Science and Medicine. Desire man with experience in all phases of medical photography. Address replys, including personal resume, to Clerical and Service Personnel, Purdue University, Lafayette, Indiana.

AMA Awards For Photography 1961

The American Medical Association at its 110th annual meeting in New York City, June 25-30, 1961 made two awards for photography that appeared in the Scientific Exhibits.

A Certificate of Merit was awarded to Wendell G. Gingrich, M.D., and Mary E. Pinkerton, Ph.D., University of Texas Medical School, Galveston, Texas. The title of the exhibit was "Ocular Fungus Infections". The photographs in this exhibit consisted of 8 x 10 inch color transparencies and 4 x 5 inch color prints. The transparencies were close-up photos of the human eye, photomicrographs, photos of culture plates and tubes and copies of roentgenograms. The legends with these were negative transparencies. The color prints were mounted on wall panels with hand lettered legends. The large main heading was a negative transparency with part of it having an overlay of color. While the photography was not done by professional photographers the general quality was good and this well balanced exhibit made very effective use of photography in presenting the story.

Honorable Mention was awarded to Mr. Ben Morton, medical photographer, Bowman-Gray School of Medicine, Winston-Salem, N.C. The title of this exhibit was "Gastric Cytology" and was prepared for J. H. Smith Foushee, M.D., Zelma Kalnins, M.D., Robert P. Morehead, M.D., Fritz R. Dixon, M.D., and Sidney Girsch, M.D. This exhibit contained two large center panels having 8 x 10 inch color transparencies of gross specimens and microscopic sections. Side panels carried some excellent 8 x 10 inch color prints of procedures. The material in this exhibit was well organized and the general effect was pleasing to the eye.

There were a number of other exhibits that contained photographs of good quality but were not considered for awards for various reasons. In some instances it was not possible to determine the name of the photographer and in other cases the photographs consisted only of a series of photomicrographs all made at one magnification. While these did tell a story they did not demonstrate the versatile use of photography that appeared in the award winning exhibits.

The judging committee members consisting of Leonard A. Julin, Chairman, Thomas J. Lannon and Percy W. Brooks viewed 382 exhibits in arriving at their decision. The exhibits this year contained a greater number of photographs than last year but also fewer photographs of poor quality. Also this year it was noted that more exhibits carried credit notices giving the names of the medical photographers and medical illustrators who had prepared the exhibits. Again this year it was noted that there were a number of scientific exhibits that had been subsidized by drug companies and had been prepared by commercial builders of display exhibits.

LEONARD A. JULIN
July 10, 1961

Journal of the Biological Photographic Association Vol. 29, No. 3 August, 1961

Reproduction of 35mm Color Transparencies With Ansco No. 544 Duplicating Film

JOHN P. VETTER

Chief of Medical Photography, Department of Pathology
Western Pennsylvania Hospital, Pittsburgh 24, Pennsylvania

AN increased use of visual aids and a partial reorganization of files in our medical programs forced us to duplicate many 35mm color transparencies (Kodachrome Type I).

We discovered two major disadvantages in commercial duplicating services. (1) Frequently-used transparencies would be out of circulation for two weeks or more. (2) The delay is greater and the cost higher if changes in size (cropping), color, or overall density is desired. Furthermore, the results vary considerably.

Fortunately, these problems have been solved for us by the recent introduction of Ansco No. 544 Color Duplicating Film which, incidentally, is compatible with the standard Anscochrome processing kits. This film has excellent ability to reproduce color, density, and detail from the original slide and affords the possibility of salvaging the "imperfect" transparencies.

The Optical-Mechanical Setup

The type of subject matter we photograph requires optimum reproduction of detail. Most reproduction systems use a diffuse light source which, however, results in a loss of detail. The increased detail afforded by condenser enlargers suggests that a condenser type light system be used in the design of duplicating equipment. Experimentation with two light sources proved that the condenser system was superior in the preservation of detail (Figure 1A) to the diffuse system (Figure 1B).

The Leitz Macro-dia apparatus was available and met the requirements of a condenser-type light source (Figure 2). With the addition of a Leitz Macro-mirror-reflex attachment, the objective lens and the reflex camera can be moved freely on the prismatic bar, thus providing a variety of magnifications. With a 100mm condenser lens and a 100mm objective lens, a magnification range of 1:1 to 1:4 is possible. This represents a practical degree of enlargement.

The filter pack, including neutral density filters, is introduced in the optical light train near the light-collecting lenses (Figure 3). Slight variations in the filter, when placed near the light-collecting lenses, are not visible in the focal plane; therefore, the color-printing ("C-P") filters by Kodak are acceptable.

The optical-mechanical setup allows accurate centering, precise focusing, and general mechanical convenience, permit-

Figure 1A, 1B. Condenser illumination was used to illuminate the slide "A". Notice the increased detail as compared to slide "B" which received diffused illumination. When projected, the comparison becomes more significant.

Figure 1A, 1B. Condenser illumination was used to illuminate the slide "A". Notice the increased detail as compared to slide "B" which received diffused illumination. When projected, the comparison becomes more significant.

ting us to photograph more than one slide per minute.

The Filter Pack and Exposure

Our basic filter pack consists of a 2B, 0.10 yellow, and a 0.20 magenta "C-P" filters. When the Leitz low voltage lamp (LINID) is drawing 5½ amps, this filter combination will give us almost perfect color reproduction. It is obvious that other setups may require a different filter pack, but at least this represents a starting point. You can arrive at the proper combination by the trial-and-error method.

Exposures are determined by measurement of light at the ground glass (Figure 4). By doing this, we eliminate all exposure factors due to: (1) the lamp output, (2) the filter pack, (3) the objective lens diaphragm, and (4) the bellows extension. Measurements are taken with a clear field, i.e., no slide in place.

We use a Photovolt No. 520-M photometer. The probe-head is fitted with an S-4 phototube, a ⅜" cone, and a No. 106 Wratten filter. With a 1.0 neutral density filter in the filter pack and a reading of 50 on the x1000 range, a proper exposure will be of a half second duration. We realize, of course, that this has little reference value to anyone else. A Brockway Director meter reading 20 with no slide or photosphere provides a practical reference point (Figure 5). It is desirable to keep the exposure duration constant. Variations of illumination at the ground glass can be compensated by the addition or subtraction of neutral density filters in the filter pack.

Correction of Imperfect Original Transparencies

Because of the inherent characteristics in this duplicating film, poor color balance or excessive density in the original can be corrected with very satisfactory results.

A rather simple but satisfactory method of determining the proper "C-P" filter or neutral density filter necessary to correct an unsatisfactory slide is by visual comparison with a normal or "test" slide. Color densities will be found by viewing and applying filters to a normal slide until the normal slide matches the slide to be corrected in both color and density. These densities should be *subtracted from* the basic filter pack. An alternate method is the application of filters to the imperfect transparency,

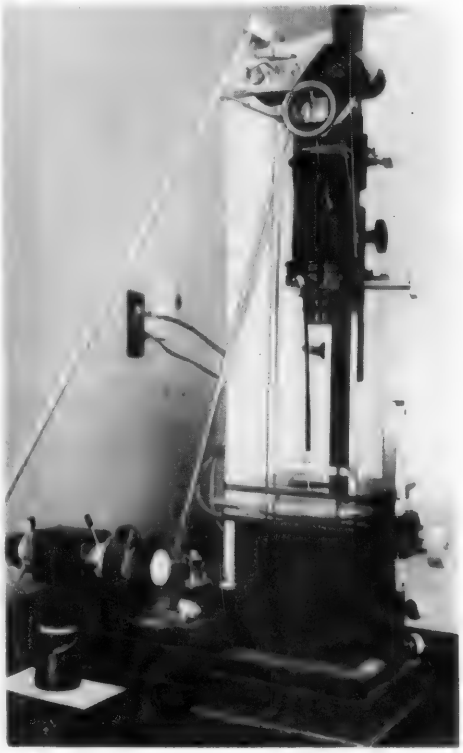

Figure 2. The efficiency, both mechanical and optical, of the setup permits rapid reproduction of 35mm color slides.

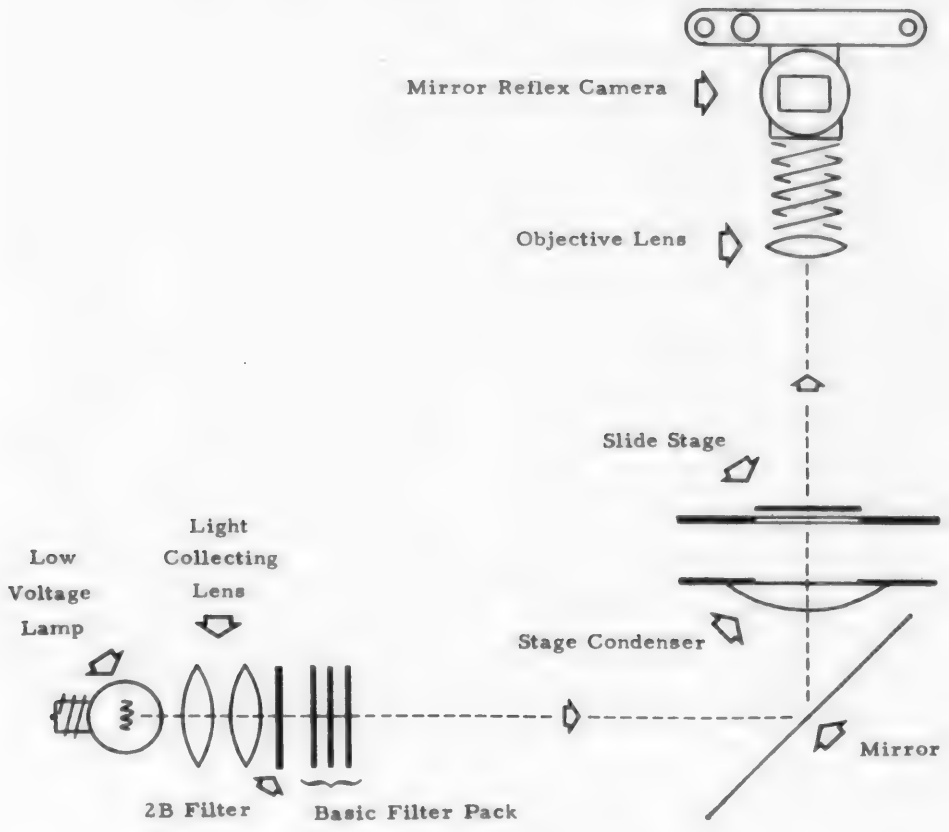

Figure 3. Schematic of basic outfit; other setups can be used with similar optical and mechanical units.

in which case these filter densities are *added to* the filter pack. The former method is more desirable since it removes densities from the pack. Excessive filters may produce unexpected color changes.

Processing

We arrived at the processing times empirically and not all of them represent Ansco's recommendations (Table I). But the processing solutions and the manipulation of them are conventional. However, for the re-exposure the film must be unwound and placed in a pan of water during the exposure. After the re-exposure, the film is again wound on the developing reel and processing continues normally. When the film is dry, it should be given a reverse curl and secured by a rubber band until mounted. Variation in contrast may be produced, if desired, by adjusting the processing time in the first developer.

"REPRODUCTION OF 35MM COLOR TRANSPARENCIES WITH ANSCO #544 DUPLICATING FILM"

By John P. Vetter

TABLE I

Temp 68°F (20° C)
Agitate 15 sec. each minute

	1st* 30 exp. Roll	2nd* 30 exp. Roll	3rd* 30 exp. Roll	4th* 30 exp. Roll
First Developer	8 min.	8¼ min.	8½ min.	8¾ min.
Short Stop (Agitate Continuously	2 min.			
Hardener First Minute)	4 min.			
Wash	5 min.			
Re-Exposure	6 min. with #2 photoflood at 4 feet			
Color Developer	12 min.	12½ min.	13½ min.	14½ min.
Short Stop (Agitate continuously	2 min.			
Hardener First Minute)	4 min.			
Wash	4 min.			
Bleach	8 min.			
Wash	4 min.			
Fixer	4 min.			
Wash	5 min.			
Stabilizing Rinse	5 min.			
Wash	5 min.			
Final Rinse	30 sec.			

*Note: Developer time variations are for 1 pint of processing solution.

Figure 4. Light is measured with a clear field, i.e., with no slide on the focusing stage.

Figure 5. Photometric readings can be made with an incident light meter. No slide or photosphere is used.

Conclusion

A method of exposing and processing Ansco No. 544 Duplicating Film has been described. The advantages of the method are (1) excellent detail and color reproduction, (2) the ability to compensate for poor color or excessive density, and (3) the saving of time and money. Total cost of the film and the processing solutions is conservatively estimated at five cents per exposure.

Acknowledgements

I am indebted to Dr. Richard G. McManus, Director of the Department of Pathology, not only for the assistance in preparing this paper, but also for his interest in and encouragement of photography, which made this paper possible.

MEDICAL AND BIOLOGICAL ILLUSTRATION

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Surface-Contact Microscopy: Studies in Cell Movements . . . . . E. J. Ambrose and P. C. T. Jones

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- Combined Developer-Fixer.
- Photosensitive Balloon for the Detection of Gastric Carcinoma.
- "Artype" Numerals, Symbols and Alphabets.
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Journal of the Biological Photographic Association Vol. 29, No. 3 August, 1961

A Practical Motion Picture Stage for Use in Recording Behavior in Mice

DANIEL R. FARNELL*, D.V.M., AND J. RICHARD THOMSON, M.S.
Chemotherapy Division, Southern Research Institute
Birmingham 5, Alabama

Abstract: An inexpensive motion picture stage is described for use in recording behavior in mice. Special construction features prevent escape of the animals, but at the same time permit simultaneous, unobstructed viewing of the subject animals, a label describing the subject material, and a clock-face showing time relationships.

IN studies relating to pharmacology, toxicology, and psychology, motion pictures are often a valuable means of recording the behavior of experimental animals.

In order to satisfactorily photograph the physical reactions of mice to various drug treatments, a small stage was needed which would prevent escape of the animals but at the same time permit an unobstructed, evenly-illuminated side view of the animals.

A stage was desired which would permit a continuous view, unobstructed by the subject animals, of a clock-face, to illustrate time relationships—as well as an unobstructed view of a legible label.

These requirements were fulfilled by a stage which consisted of a box divided into two compartments, one side for the clock and label, and one side for the animals (Figure 1).

The front portion of the floor of the animal compartment (Compartment B) was inclined upward at an angle of approximately forty degrees, the same angle from which the camera was operated above the horizontal. This inclined portion of the floor prevented the animals from climbing forward except with great difficulty; but, since the camera was elevated at the same angle, the inclined portion of the floor did not obstruct the camera view of the animals. The sides and rear wall of the animal compartment were vertical and high enough to prevent the animals from escaping.

An inclined, false floor perpendicular to the line of vision of the camera was built into the other compartment (Compartment A). This allowed an undistorted view of the label and clock-face. The clock was recessed so that the clock-face was flush with the false floor of the compartment.

The stage was constructed of hardboard at a nominal cost and was painted with a flat, latex-base paint.

The camera was fastened to a folding, wooden stand (Figure 2) which kept the camera lens (36 mm telephoto) at a constant distance and angle in relation to the stage. With this apparatus, plus an ap-

*Present address: Department of Physiology, School of Veterinary Medicine, Auburn University, Auburn, Alabama.

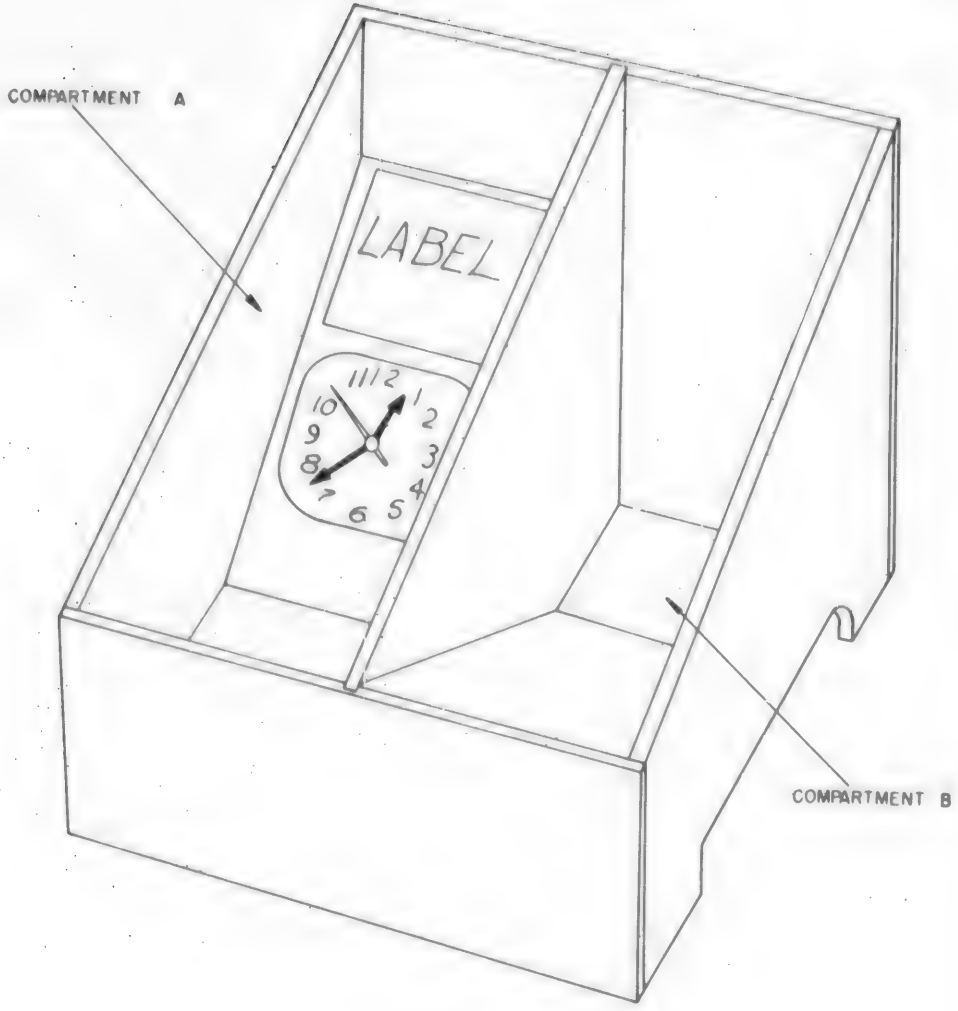

Figure 1.

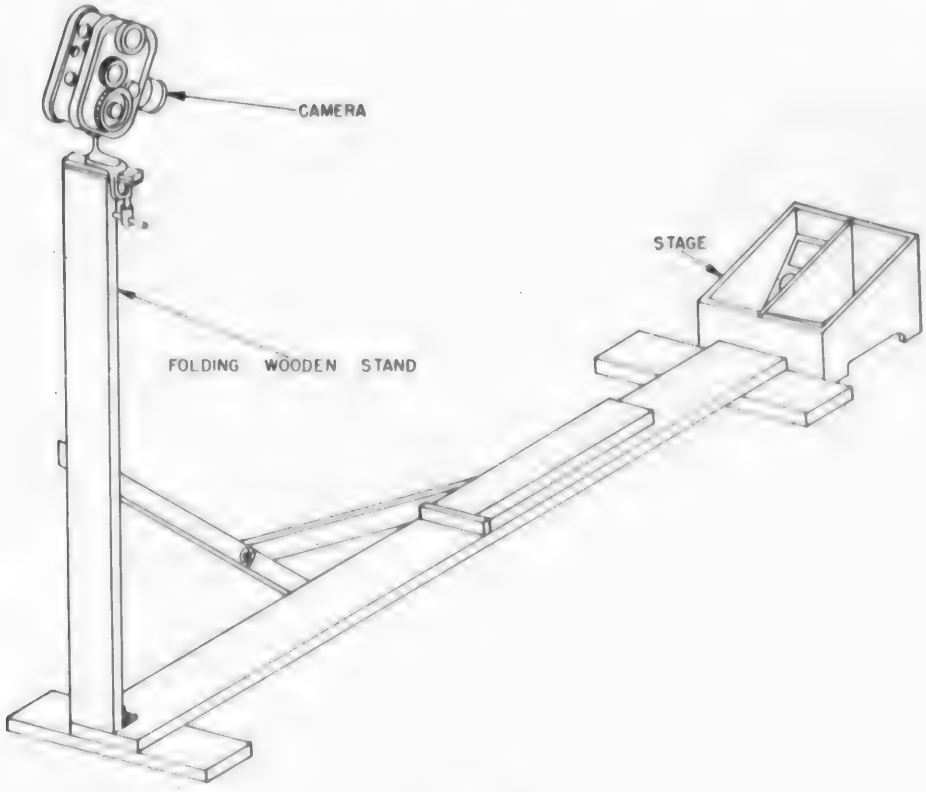

Figure 2.

Figure 3.

propriate light source, motion pictures of mice can be made conveniently with consistently satisfactory results.

Figure 3 shows field of view from camera position using the apparatus described.

Journal of the Biological Photographic Association . . . Vol. 29, No. 3 August, 1961

An Application of the Polaroid Land Camera in Medical Photography

EUGENE W. FODOR

Department of Medical Photography
St. Peter's General Hospital, New Brunswick, New Jersey

ADAPTATION of the Polaroid Land Camera to meet the specific needs in the Surgical Pathology Department of St. Peter's General Hospital has been an accomplishment which we feel could benefit others, particularly since the improvisation is both simple and inexpensive.

Hoping to show the advantages of the Polaroid Land Camera in a Department of Medical Photography, I am presenting our adaptation as it applies specifically to the photography of a surgical specimen.

Many articles have been written about the use of the Polaroid in various areas of photography. However, little has been written concerning medical photography with the Polaroid.

By purchasing a simple and inexpensive attachment we have made this camera an important part of our surgical specimen report. We find that the old adage, 'A picture is worth a thousand words' is very true, but a photograph coupled with a written observation or description is worth even more.

The inclusion of a photograph on the surgical report is of great assistance to the surgeon when he reads the pathologist's report. The gross surgical reports in this hospital are dictated on the same day that the surgery is performed. The written report is ready the following day. This was the reason for employing the Polaroid. It is simple, convenient, time saving, and inexpensive to operate.

Figure 1 shows the Polaroid Model 95, attachments, Polapan 200 film, and the Weston III meter. The accessory is the Close-up Lens Kit No. 540. This includes the +1, +2, and +3 lenses, which are used separately or together to obtain the desired results. A roll up ruler is part of this kit. It is used to measure the size of the specimen and it is also used in focusing on the specimen. The film used is the Polapan 200, which we find ideal for our situation. The illumination is produced by two No. 1 photoflood bulbs. A Weston III meter is used to determine exposure. The maximum area of the copy field is eleven inches by fifteen inches. This area is covered by a sheet of quarter-inch clear glass under which there is a blue field. The stand on which the camera is raised and lowered is thirty-nine inches high.

Figure 2a and Figure 2b are surgical Polaroid with the above-mentioned attachment. Fig. 2a is a close-up of a section of transverse colon showing carcinoma. Fig. 2b is a close-up of carcinoma of the rectum.

The method of reaching the correct exposure is simple. The overhead lights are turned out and the No. 1 photoflood lights are turned on. The exposure meter

Figure 1. Polaroid Camera, attachments and Weston III meter.

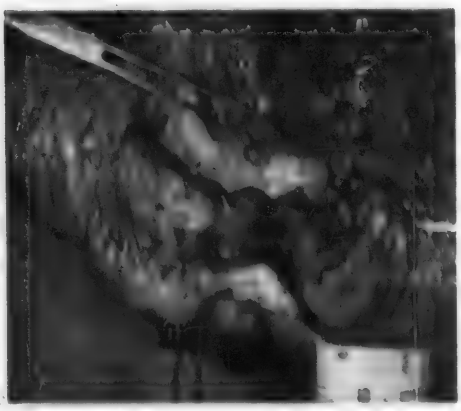

Figure 2a. Polaroid photo of Carcinoma of transverse Colon.

Figure 2b. Polaroid photo showing Carcinoma of the Rectum.

is set at an A.S.A. of 200; a reading is made off the specimen, and the light value will appear in the Polaroid window of the Weston III meter. The opening will usually be between 3 and 5. The specimens photographed were all taken at an opening of 4.

In positioning the specimen under the camera; the photographer looks through the viewfinder. When the section of the specimen which is to be taken appears in the center and to the rear of the finder, the specimen is in position to be photographed. . .

After the positioning and focusing and setting of the diaphragm are completed, the only thing left is the exposure. Ten seconds after the exposure is made the print is removed and coated. We now have a fixed image of what our specimen looked like. It is noted that in this process we do not need a darkroom or developing tank; or any of the other processing paraphernalia.

In conclusion, this set up has been a labor and money saving investment. It offers a more complete surgical record.

The procedure could be very useful not only in a Pathology Department such as ours, but also in other areas of the hospital where an instant photograph would be valuable.

ACKNOWLEDGEMENTS

Polaroid Land Corporation,
Cambridge, 39, Massachusetts

Daystrom, Incorporated,
Weston Instruments Division
Newark, New Jersey.

Wm. A. Jarett, M.D.
Chief Pathologist
St. Peters Gen. Hosp.
New Brunswick, N. J.

Time Lapse Cinematography as a Method of Studying Animal Behavior and Ration Preferences[1]

LOUIS A. FACTO[2] AND DAMON V. CATRON[3,4]

Introduction and Purpose

IN areas of scientific endeavor where animals are the experimental base, many of the conventional and traditional methods of investigations may not be providing valid and reliable conclusions. This may be true because these methods do not consider parameters associated with patterns and manners of behavior.

The investigations described herein indicate that normal behavioral variations among individual animals may greatly influence the experimental results. Even with randomization techniques and specialized experimental designs, the enigmas became evident concerning just what young pigs living under experimental conditions do when left to their own devices when ration preferences exist as the primary experimental criterion: Does the average ration consumption per day or per pen really represent the preference for one ration? Or, are a small fraction of the pigs in the pen responsible for what appears to be a significant difference of ration consumption?

These and similar questions helped define the purpose of this study which was: To investigate by means of a time lapse cinematographic technique the uniformities and peculiarities of baby pig behavior patterns that correlate with their intake of feed and/or preference for different feeds.

Procedure

Two sets of two pens of young pigs were time lapse cinematographically recorded at different dates, different ages, with different pen sizes and with different pen populations per unit area. Figure 1 illustrates one set of the pens of pigs, numbered 7 and 8, that was recorded cinematographically. Each pen contained 4 pigs, eight weeks old, that had been weaned at the age of two weeks. Two

[1]Journal Paper No. J-4064 of the Agricultural and Home Economics Experiment Station, Ames, Iowa. Project No. 968 & 1032. The work reported was partially supported by a grant-in-aid by the Flavor Corporation of America, Chicago, Illinois.

[2]Louis A. Facto, Ag. and Home Ec. Exp. Sta. Photographic Lab., Iowa State University, Ames, Iowa.

[3]Damon V. Catron, Walnut Grove Products Co., Inc., Atlantic, Iowa. Formerly Animal Husbandry Department, Iowa State University, Ames, Iowa.

[4]The authors gratefully acknowledge the assistance of Francis Diaz in coordinating various phases of these studies.

[5]The flavored rations used in these experiments were prepared by adding to a basal ration specified amounts of synthetic and/or natural flavor sources combined to simulate or produce individual flavors characteristic of sow's milk, caramel, and a sweetening agent. These flavor additives were supplied through the courtesy of the Flavor Corporation of America, Chicago, Illinois.

[6]The genetic effect of irradiation of swine. Bilsland Farm, Iowa State Univ., Ames, Iowa.. Contract AT(11-1)-707, from U. S. Atomic Energy Commission.

[7]TCI No. 2104, Technical Sales, Inc., Detroit, Michigan.

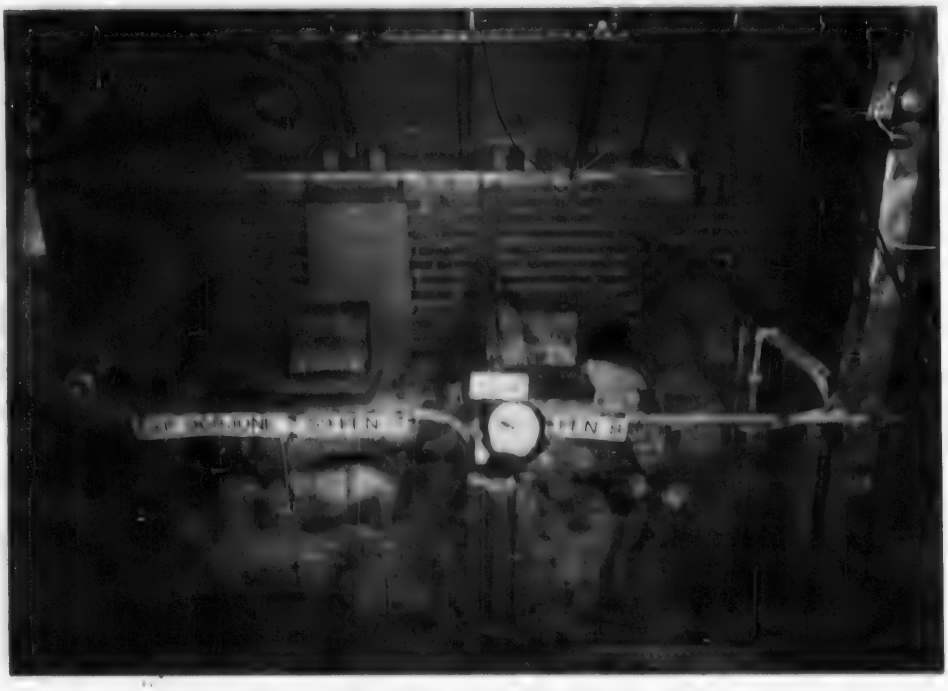

Figure 1. One set of the pens that were recorded by the time lapse cinematographic technique is shown. Identification signs depicting experiment number, date, and pen numbers were attached to pens. Also, a clock was situated within the camera view to facilitate recording the exact time that certain behavioral events occurred.

different rations, one basal and one flavored,[3] were placed in separate labeled feeders in each pen. The placement of these feeders was interchanged within the pens at approximately 24-hour intervals. The feeders were weighed at weekly intervals. The pens were illuminated 24 hours a day with four 250-watt reflector lamps located six feet above the floor. Identification tags depicting experiment number, date and pen number were attached to the pens. A clock was placed in camera view to facilitate determining the exact time that any significant recorded event occurred. The activities of these pigs were cinematographically recorded for three and one-half days. The floor plan of Pens 7 and 8 is shown in Figure 2. Hereafter, this earlier study will be referred to as Experiment 968. At a later date, the activity within two pens containing 5 pigs each was recorded in a similar way to those recorded in Experiment 968 except for the following differences: These pens averaged twice the size of those just described and are illustrated in Figure 3. These pens were time lapse cinematographed singly, in an alternating fashion. Four days were recorded from each pen. Two of these days per pen were recorded at the beginning of the experiment, and the remaining recordings were made approximately three weeks later immediately prior to the termination of the experiment. The two feeders within each of the two pens, numbered 3 and 4, were placed

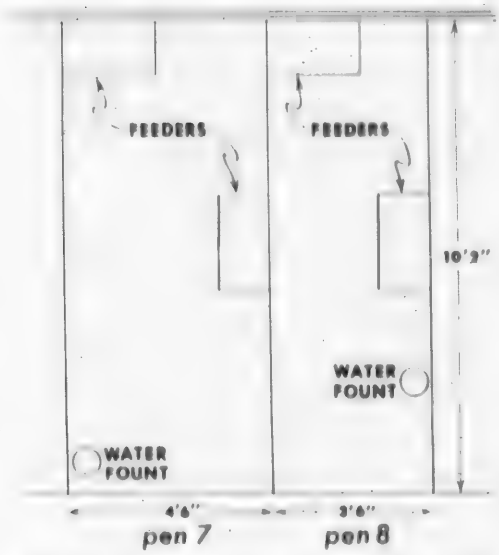

Figure 2. Pens 7 and 8, in Experiment 968, were laid out as illustrated. The position of the feeders within each pen was interchanged daily.

equidistant from the water founts. Both feeders in Pen 3 contained a basal ration and were labeled so that proper identity was always known. Two different rations, one basal and one flavored similar to those flavored rations used in Experiment 968, were placed in separate labeled feeders in Pen 4. All the feeders were weighed and their placement was interchanged within the pens at 24-hour intervals. This latter experiment is identified as Experiment 1032.

More recently, two clips of time lapse film were shot at another site of experimental investigations involving young pigs.[6] These depict (1) a farrowing scene and (2) nursing habits of two week-old pigs.

Figure 4 illustrates the camera equip-

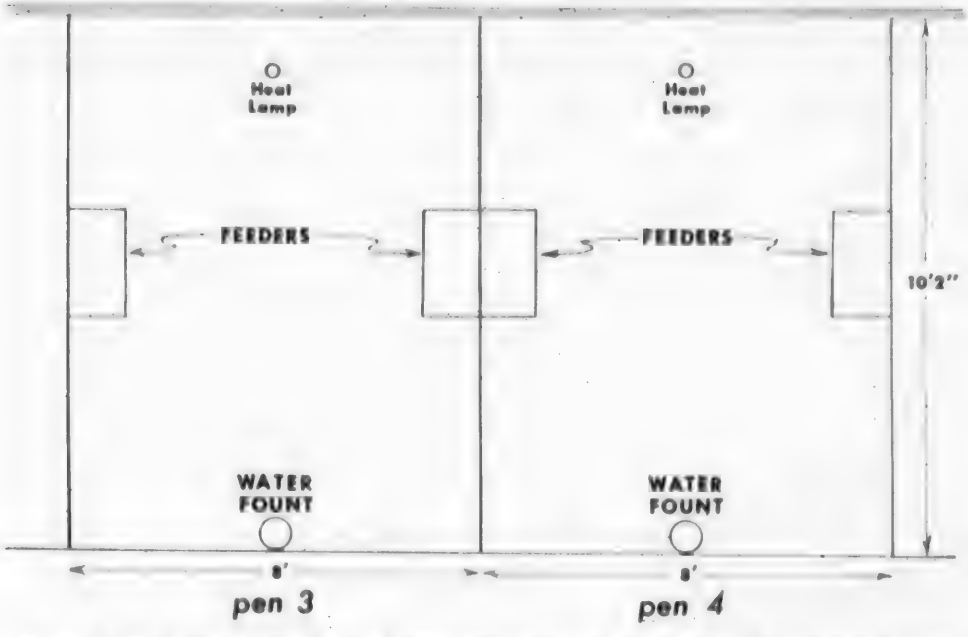

Figure 3. The feeders were placed equidistant from the water founts in Experiment 1032. Also, the dimensions of the pens used in Experiment 1032 were larger than the pens used in Experiment 968.

Figure 4. Time lapse camera is shown in operating position. The special camera drive and the associated Lektra model TM-8 interval timer and Agastat time delay relay, type NET-16-Q are visible.

ment used to record these studies. The camera was a Kodak Ciné Special II equipped with a 200-foot magazine and a 13mm f/1.9 Elgeet wide angle lens. The camera drive was especially designed and built for this application. A Lektra, model TM-8, interval timer and an Agastat time delay relay, type NET-16-Q, were used to actuate a pulse to operate the camera and maintain a selected time interval between single frame exposures. The time lapse technique was used to conserve film and also to condense the pigs' actions into a relatively small film unit that would be easy to analyze.

Before starting Experiment 968, the pigs were observed visually to find out how long it took them to eat and drink. It was observed that when a pig went to a feeder, he usually remained there for at least 15 to 20 seconds. By cinematographically recording slightly faster than this 15 to 20 seconds, it was assumed that the camera would be able to record practically every movement the pigs made during a 24-hour period. Exposures, therefore, were made at intervals

Figure 5. The data observed from the projected film was transcribed to a long sheet of graph paper to facilitate efficient analysis.

of every 12 seconds. In this way, a 24-hour day was condensed into slightly over 5 minutes of normal projection time, and almost 200 feet of 16mm Eastman Tri-X negative film was used per day to record the actions of the young pigs.

One condition of Experiments 968 and 1032 involved being able to identify each pig from the film when it was projected. In Experiment 968 there was one spotted pig and three white pigs in each pen. The spotted pig in each pen could easily be identified. By marking dark stripes with a marking crayon on the backs of the two white pigs in each pen, in ob-

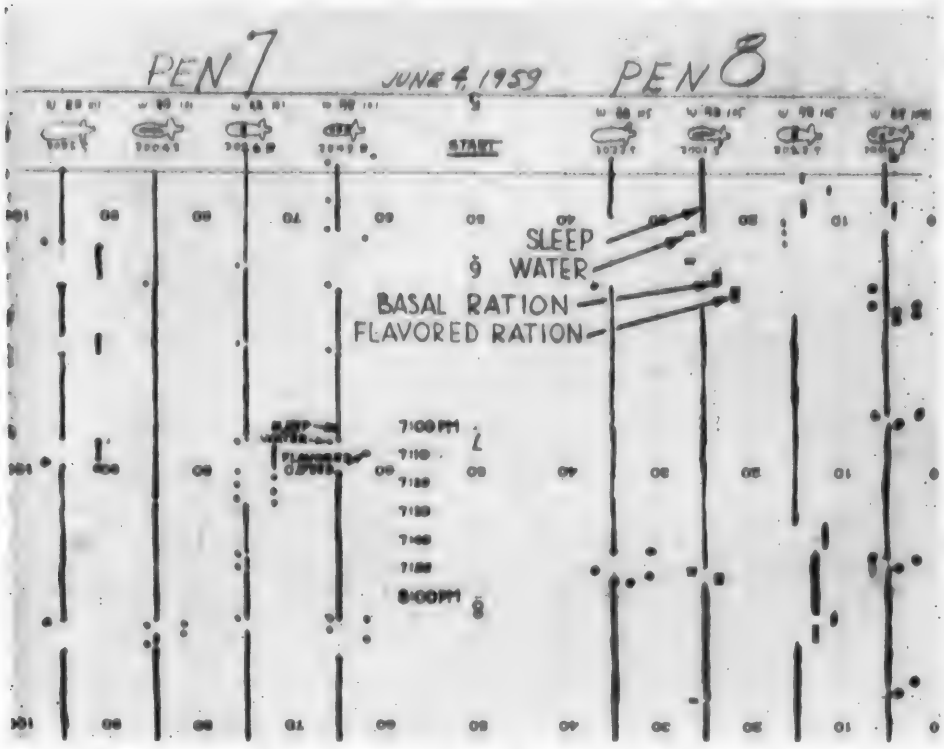

Figure 6. The activities of the pigs were coded and tabulated in this manner so that behavioral patterns could be analyzed and compared.

viously contrasting ways, it was possible to prevent the problem of mistaken identity when the films were analyzed. This marking technique was modified slightly to mark the five white pigs in each pen in Experiment 1032.

An important part of this study was to keep a clock in camera range so that the exact time each event occurred could be determined. It was desired to confirm the hypothesis that those people attending the pigs and cleaning the pens would cause the animals to behave differently. On this basis, all the watches of these people attending or working around the pigs were synchronized with this clock, and the times of arrival and departure by these people from the building in which these investigations were conducted were recorded on a chart.

After the film had been processed, data derived from the film by a team of eight people viewing it, were transcribed to a piece of graph paper as illustrated in Figure 5. A Bell and Howell time and motion study, model 173 BD, motion picture projector was used to facilitate accurate detection and time of each animal's actions. To transcribe one day's film representing Experiment 968 required about three to four hours' work by the team. Films representing three and one-half days were tabulated in this way.

Figure 7. A recorder was designed and built to permit more accurate and more rapid tabulation of the data derived from the projected film.

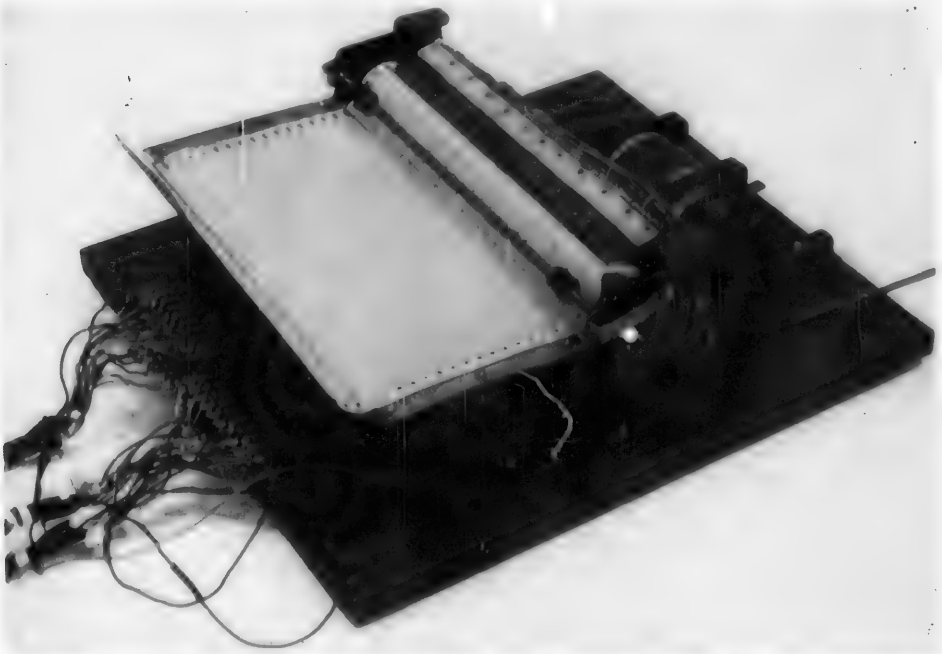

Figure 8. The recorder was synchronized with the projected film by selsyn drives. One hundred and one channels were available for simultaneous recording.

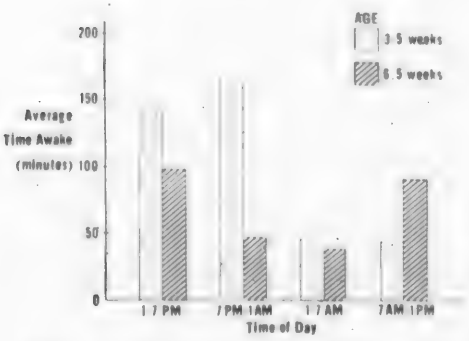

Figure 9. The average time awake during different periods of the day for pigs of different ages, 3.5 and 6.5 weeks, as tabulated from Experiment 1032.

By indicating the animal's activities as shown in Figure 6, it was possible to compare the activities of individual pigs, compare the behavior patterns between pens or study those patterns occurring in both pens simultaneously. The long line going down the center under each pig identification indicates that they were sleeping or resting. The dots to the left regard drinking activities, and those to the right represent visits to either the basal or the flavored rations.

To tabulate the results of Experiment 1032, involving eight days of film, by the above mentioned approach would have been too time consuming. Also, it was desired to account for 12 different behavior activities as compared with the 6 previously tabulated with reference to Experiment 968.

Figure 7 shows the synchronized recorder that was designed and built to be coupled to a motion picture projector.

The graph paper in the recorder was synchronized at all times with the film while the film was being projected and analyzed. The projector, a Revere model 48-16 projector, was modified to provide, in addition to an adjustable "fast" forward travel, a "slow" forward and reverse travel ranging from ½ to 1 second viewing time per frame. The data were transcribed to the electric writing graph paper[7] in the recorder by means of coded buttons on switch panels obtained from obsolete juke boxes.

A close-up of the recorder as illustrated in Figure 8 reveals that a total of 101 separate channels were available for simultaneous recording. The use of this recorder reduced the tabulating time to approximately 1 hour per 24-hour recording.

Results

One of the findings was that the animals visited the feeders more in the daytime than at night. This was because they appeared to be oriented to a 24-hour day even though the artificial illumination of their pens was constant. That is, they were awake more in the daytime than at night. Figure 9 depicts the awake periods of young pigs of two different age groups as obtained from the data representing Experiment 1032. It is interesting to note that there was a tendency for the 3.5-week-old pigs to be awake more from 7 p.m. to 1 a.m. than when they reached the age of 6.5 weeks of age. Also, as these young pigs grew older, they appeared to be awake for longer periods of time during the 7 a.m. to 1 p.m. period of the day. Too, these pigs spent most of their time sleeping, or at least resting, day and night. It was calculated that 85% of their day was consumed in this manner, and that each pig or group of pigs had preferred places in the pen where they slept.

It was noticed that there was a preference for the flavored ration over the basal ration when the data for Experiment 968 were tabulated. This tabulation did not verify other aspects of Experiment 968 as a whole. However, when the tabulation of visits to the feeders was regrouped on the basis of which feeders were closest to the water, see Figure 2, it was noticed that the feeders which were closest to the water were those most frequently visited by a wide margin — regardless of which rations they contained. It was not, however, determined whether or not this association was established by any preference association earlier in the experiment.

In Experiment 1032, as mentioned earlier, the feeders were purposely placed in the pens in such a way that the feeders were equidistant from the water, as is indicated in Figure 3. This was done in order to investigate effect of ration flavor when the "closeness to water" bias was removed. The feeders in Pen 3 contained only a basal ration in order to check the possibility that other factors affected the manners in which rations were consumed. When Experiment 1032 was analyzed, it was found that visits to the feeders, when compounded for both pens, did not completely verify the expected result. In short, the analysis simply indicated that even modified current techniques used to determine feed preferences may be somewhat amiss. Nevertheless, when the acceptable data were analyzed, two facts were evident.

1. It was calculated that the feed consumption rate per visit in Pen 4 at the end of Experiment 1032 was greater than that representing Pen 3.

The only explanation for the increased consumption of feed per visit in Pen 4 is the fact that the flavored ration in this pen constituted or produced a feed taste comparison basis for the growing pigs. As a result, they were induced to eat more feed per visit because they truly liked one ration better than the other.

2. The pigs in Pen 3 learned to follow one feeder from one side of the pen to the other when the feeders were interchanged at 24-hour intervals, even though the rations these feeders contained were the same. This particular behavior could have affected previous similar experimental results.

Each pen of pigs contained a leader. In the past, this leader has been labeled as the biggest, strongest pig. Experiments 968 and 1032 indicate that the pig that initiated the action in a given pen was not necessarily the biggest and strongest, but may have been in fact the smallest.

Watching the films projected at normal projection speed, whereby the action was speeded up 288 times, caused the authors to notice that certain rhythmical gross patterns existed. These patterns were verified by the transcribed graphs regarding sleeping patterns, and patterns associated with eating and drinking.

Many specialists have often thought that attendance of people in the vicinity or working around young pigs caused them to be nervous, but nobody had been able to prove this.

One film clip from Experiment 968 projected at normal projection speed offered conclusive proof that people can cause the pigs to behave differently. The first part of the clip portrayed pigs behaving normally. Later, at a specific time, an attendant arrived in the building. At this time, the activity greatly increased and the pigs appeared nervous. A few minutes after the attendant had left the building the pigs were normal again.

Another selected film clip from Experiment 968 showed one pig in Pen 7 going to eat and the rest following to eat with him. This sense of "togetherness" seemed to be oriented according to pens, because it was noticed that when the pigs in Pen 8 went to eat, the pigs in Pen 7 didn't pay any attention. Each individual pig, though, seemed to have his own individual manner in which he ate, which can be observed by examining the patterns visible in Figure 6. Some pigs first got a drink of water before eating and ate at only one feeder at a given time. Other patterns not similar to this one indicated that the pigs definitely ate in an individual manner but were governed to a large extent by the actions of others within the same pen.

Reviewing these films many times revealed that much of the activity seemed to be of conditioned response origin, and other behavior seemed to indicate that young pigs possess measurable amounts of intelligence and personality. Some of the time lapse work in connection with the Atomic Energy Commission irradiation studies at Iowa State University offered a preview in checking some of the features of intelligence, conditioned response, and personality. Two film clips from this site depicted a farrowing gilt and a litter of two-week-old pigs. The action depicted in these clips was speeded up 80 times by projecting the film normally.

Several situations were noticed from

this farrowing scene which illustrate what might be called intelligence. Three examples were:

1. Some baby pigs appeared to know what to do, and what direction to go immediately after birth.
2. Some went the wrong direction or wandered and got lost.
3. Some baby pigs, even though they strayed off, did find their way back to nurse unaided.

Two weeks after farrowing, baby pigs have already been conditioned by their mother to lead a set pattern regarding life. True, they were individuals, but they all acted together. The mother gilt "called" them to eat at approximately 60 to 80 minute intervals. Between feeding periods there were supervised exploration parties, play sessions and naps. It was noticed that the mother gilt didn't sleep till she was sure that her litter brood was asleep.

Behavior patterns set up during these days may influence the behavior patterns and eating habits of the pig throughout life.

Summary

The behavioral patterns regarding feed intake and feed flavor preference were studied with respect to two sets of two pens of young pigs at different dates, ages, and conditions. It was assumed that every action of each pig was recorded by the time lapse cinematographic recording technique. A clock was included within the camera view, and each pig was marked in a way that made it possible to readily identify any animal and assign an exact time to any of the actions that occurred.

By specially tabulating data from the film and transcribing this data to a long piece of graph paper it was possible to describe several unique qualities regarding the eating habits and associated patterns of behavior of young pigs.

It was shown that:

1. The young pigs ate more during the day than at night.
2. The young pigs were oriented to a 24-hour day, even when illumination of their pens was constant.
3. The young pigs slept more at night than in the daytime, but the specific distribution of sleep over a 24-hour period was related to the age of the pigs.
4. It was calculated that approximately 85% of the young pigs' day was spent sleeping, or at least resting.
5. Pigs tended to visit those feeders which were closest to water regardless of the ration they contained,—when two feeders containing different flavored rations had been placed in each pen.
6. When the two feeders in each pen had been located equidistant from the water founts, it was shown that young pigs may learn to follow one feeder that is interchanged daily with another even though both contained the same ration.
7. If one of the feeders, of those placed equidistant from the water, contained one ration with a flavor that the pigs preferred over that of the basal ration contained in the other feeder, their expression of this preference was shown by eating more of the feed per visit.
8. Each pen of pigs contained a leader pig. These leader pigs were not

necessarily the biggest and best doing pigs as might be supposed.

9. Those attending or working around the pigs did cause the pigs to behave differently. The differences of behavior appeared to be that of a general nervousness.
10. Pigs in a given pen tended to eat together.
11. Pig activity in pens did not appear to have any appreciable effect on the particular behavior in neighboring pens.
12. While young pigs in a given pen ate and played together, each pig still retained identity as an individual. This fact was most evident when individual eating habits were compared.

Much of the above mentioned behavior concerning feeding activity and/or preferences regarding certain rations may be more completely explained in terms of such concepts as—(1) conditioned response, (2) intelligence, and (3) personality.

It was observed from a time lapse cinematographically recorded farrowing scene and a scene depicting two-week-old pigs that young pigs exhibit what might be called intelligence at the time of birth. Also, it was shown that two-week-old pigs had been taught certain ways and patterns of behavior by the mother gilt. Too, the individually oriented behavioral tendencies of these two-week-old pigs indicated they possessed a type of personality.

While these studies were, more or less preliminary in nature, evidence was presented revealing that time lapse cinematography may be a useful technique in studies where the behavior patterns of animals undergoing experimental treatment may be a factor influencing the experimental results.

BOOK REVIEWS

PLANT MARVELS IN MINIATURE *by Dr. C. Postma, Bussum, The Netherlands, Foreword, by Edwin Way Teale, 10" x 13", 173 pp., 77 plates, $12.50.*

This book invites you on a fascinating photographic exploration into the plant world. The author, a scientist who is also a superb photographer, begins each chapter with a slightly enlarged photograph of the various parts of the plant. Further photographs then show increasing magnification until, at 3000 times, complex and beautiful structures are revealed. At the same time the author explains how the various parts are related to each other.

Each of the 77 full-page reproductions is a fine example of the art of photography. In making these superb photographs the author has used highly original techniques. Notes on his methods are included for the interest of both scientists and photographers.

The layman will find this book a source of wonder, for it opens the door to an entirely new world. Students will find it stimulating to have a view of their subject not found in textbooks.

In the foreword, Edwin Way Teale, naturalist and author, says: "Here we find patterns and designs to delight the artist, intricate structures of lightness and strength to absorb the engineer, revelations of an unseen world, that is at once so close at hand and so far away from our everyday life, to fascinate us all."

Dr. Postma is a physician who for forty years has made a hobby of photographing through the microscope. One must admire this fascinating photographic exploration into the plant world. The photographs are beautifully reproduced by the printer, incorporated in a pleasing format.

This book is a valuable addition to any library.

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On the Photography of Unstained, Differentially Stained and Fully Stained Precipitation Lines in Agar*†

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THE photography of serological precipitation bands produced in agar gels has become a common problem at biological research centers and the methods devised to meet this problem equal the number of investigators who have faced it. Each of these methods is useful, having been designed for specific situations, none is adequate for all situations.

We[1,2] have recently described the preparation and utilization of immunozymograms and immuno-electrozymograms. These are, respectively, agar diffusion patterns and immuno-electrophoresis patterns which are stained cytochemically to reveal antigens possessing enzymatic properties. Such patterns present certain photographic challenges. First, our tests require micro-methods which result in patterns whose small dimensions make photographic or optical enlargement a necessary analytical step. Second, only one or a few of many precipitation lines take the specific stains, so it is necessary to distinguish between stained and unstained lines. Although both problems have been solved with color photography[1], the expense is prohibitive. This necessitates illustrative techniques which allow publication in black and white.

The development of an appropriate procedure for this purpose is related to the general problem of the photography of agar diffusion plates. The ideal technique produces an undistorted representation of the diffusion pattern, minimizing the various kinds of imperfections in the agar and eliminating irregularities in the receptacle containing the agar. Also, such a technique avoids the cost of special receptacles of optical quality[3,4] and minimizes the number of surfaces collecting debris as well as allowing its easy removal.

The various methods described in the literature use either transmitted light[3,6] or dark field illumination[1,5,11]. These methods of illumination satisfy the requirements for the ideal technique, if selected in accordance with the character and treatment of the diffusion plates. This paper discusses the advantages and disadvantages of these illumination methods as applied to unstained, differentially

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stained and fully stained macro- and micro-agar diffusion plates. We also describe a readily available apparatus adaptable to both types of illumination.

The Choice of Illumination:

Transmitted light: Transmitted light techniques take advantage of the differences in transmittance between the serological precipitates and the agar. These differences depend upon the character of each precipitate and the length of the light path through the precipitate. They also depend upon whether or not the precipitate is stained and whether or not contrast producing materials are incorporated into the agar or used as filters, e.g. methyl orange or orange G[3,12].

Techniques based on this type of illumination require that both top and bottom surfaces of the agar and its receptacle be optically smooth. Consequently, it is difficult to make photographic records during the course of diffusion. Another disadvantage of this technique is the inadequacy of the contrast between precipitate and agar in unstained plates having a light path of less than about 5 mm. This condition is unavoidable with the micro-techniques which result in plates less than 1 mm thick[1,13-17]. However, thin plates which have been appropriately stained may be photographed by transmitted light.

In the case of the stained plates the major disadvantage arises in the preliminary staining[16,18] rather than in the photography. The intensity and photographic properties of the stains vary with the density of the precipitates. In addition, the stains do not distinguish between the serological precipitates and the soluble reactants or contaminants. Consequently, careful preliminary washing is necessary to remove non-specific but stainable materials. Finally, the plates stained for enzymes are difficult to counter-stain for non-enzyme antigens.

Dark field illumination: The dark field technique, which makes use of the light scattered by particles, is particularly valuable for micro-diffusion patterns because of its sensitivity. This demands optical smoothness of all surfaces falling in the plane of illumination. However, by adjusting the light source, good illustrations can be made even during the course of the diffusion.

The greatest difficulty arises from unbalanced dark field illumination. This produces "butter-fly" effects with thick plates[3] or other line distortions such as "doubling" which are hard to eliminate with asymmetrical light sources[5,10,11].

Macro-plates: Transmitted light has produced excellent results with unstained Ouchterlony type macro-plates 5 mm thick. We have produced optically smooth surfaces in two ways. For one method, we removed the agar plate from the petri dish under water. This avoided breakage of the agar. The plate was then mounted between siliconized lantern slide covers using water or formalin as the immersion fluid. For the second method, we placed the petri dish on a lantern slide cover with water, oil, or glycerine as the contact medium and made the surface of the agar optically smooth by flooding with water. These two methods avoided the cost of specially constructed optically perfect receptacles[3,4] but introduced surfaces which maximized the collection of debris.

Either assembly was placed in the negative holder of a suitable enlarger where the image was brought to a standard size, focused and exposed on Contrast Process Ortho or other film. Prints were made with low contrast Kodabro-

mide paper. Experience soon indicated the exposure times appropriate to the various kinds of patterns. Care in centering the light source was necessary to avoid photographing the precipitation bands as ribbons rather than as lines.

In addition to this technique, which resembles that of Bartlett[3], we have also obtained excellent results with macro-plates using the technique described below.

Micro-plates: Both transmitted light techniques, dark field illumination and a combination of the two have been necessary for good illustration of our micro-plates. The following sections describe these techniques.

Preparation of materials:

The objects of our photography were diffusion patterns produced in circular agar blocks 22 mm in diameter and 5 mm deep with the peripheral wells 5 mm from the central well. These blocks were sliced into planchets 1 mm thick for staining in various ways. Originally[1], the stained or unstained planchets were mounted on microscope slides using glycerine jelly and a cover slip. But the cover slips became streaked with glycerine. These streaks could not be removed and were particularly evident in the "dark-field" black and white photographs[1]. This difficulty has since been avoided by drying the planchets on cleaned, unsiliconized microscope slides at 37°C for 2-4 hours. Cracking and distortion during the drying process was prevented by following previously published techniques[16].

When dry, the precipitation lines in unstained planchets were invisible. By flooding the planchets with lint-free water, however, irregularities on the surface of the agar disappeared and the optical properties for dark-field observation or photography of the lines became optimal. Repeated moistening in this way did not adversely affect the preparations if the water was shaken off and the slides returned to storage.

The apparatus for color photographs:

Color photography of micro-immunozymograms requires a balance between dark field illumination and transmitted light in order to reveal both the unstained and the stained lines. This was achieved by manipulating the optical system of a Leitz Panphot with results as shown in color photographs published elsewhere[1]. However, this set-up was complex, difficult to use, and expensive. In addition, it was not useful for routine visual observations of the planchets. A simple black and white technique to serve the purpose of the color photographs was needed.

The apparatus for black and white photographs:

Using a circular fluorescent tube, we prepared a dark-field box similar to one described by Ouchterlony[6]. It proved to be ideal for routine visual observation but a photographically more versatile arrangement is illustrated in Figures 1 and 2. A Leitz "Marco Ring Illuminator" (Fig. 1A) controlled by a standard rheostat and having a 3200 K color temperature, was inverted and mounted on a ring stand below an adjustable, flat-black specimen carrier (Fig. 1B). Centered beneath the illuminator ring was a flat black mailing cylinder (Fig. 1C), 8 inches high and 3 inches in diameter. It served as a light trap for the background. By adjusting the height

Figure 1. Macro Ring Illuminator arranged for dark field photography.

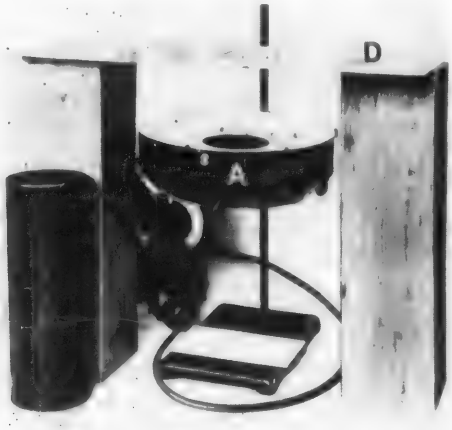

Figure 2. Macro Ring Illuminator arranged for transmitted light photoraphy.

of the illuminator and carrier relative to the cylinder, optimal dark-field lighting was obtained for either micro- or macro-agar plates or planchets. Either of these could be accommodated by exchanging the carrier for one with a smaller or larger hole. These perforated carriers avoided introducing the two surfaces of a glass carrier. Thus, only the upper and lower surfaces of the preparation itself collected debris.

A Leica camera body with Visoflex I and bellows extension and 135 mm Hector lens was mounted on a separate stand and photographs were made using Plus-X film. Prints, produced on Kodabromide paper, were enlarged so that the distance between wells was identical whether the originals were micro- or macro-plates.

This apparatus resembles that described by Schutz[7] and Klontz *et al*[8] but is less complicated. Since most of the components are standard items we were able to avoid using the work shop except for making the specimen carriers and painting the mailing cylinder.

Figure 2 shows how this same equipment was adapted for transmitted light illumination. The carrier (Fig. 1B) was removed, a white card was substituted for the light trap cylinder, and a sheet of opal glass (Fig. 2D) was placed above the focal point of the ring illuminator (Fig. 2A), thus avoiding the central dark spot. The specimen, supported on this opal glass, was adequately illuminated by a diffuse light which washed out all but the stained lines. The same purpose could also be accomplished by placing the specimen over a white background illuminated with spotlights.

Results:

Figures 3 and 4 are immunozymograms and Figure 5 is an immunoelectrozymogram. These show the reactions of frog, *Rana pipiens*, antigens tested with appopriate antisera. The peripheral wells of Figures 3 and 4 are counted counterclockwise from the upper left which is marked with a hypodermic needle hole.

In Figure 3, wells I and II contained undialyzed mature ovarian oocyte supernatant and wells III and IV contained a dialyzed preparation of the same reagent. The center well contained rabbit antiserum directed against tailbud stage supernatant. In Figure 4, well I contained normal adult kidney supernatant, well II, supernatant of the Lucké frog kidney adenocarcinoma, well III, mature ovarian oocyte supernatant, and well IV, tailbud supernatant. The center well contained rabbit antiserum directed against the Lucké adenocarcinoma. In Figure 5 mature ovarian oocyte supernatant and tailbud supernatant, placed in the upper and lower wells, respectively, were first dispersed electrophoretically and then allowed to diffuse toward antiserum to tailbud supernatant that was placed in the central trough. This anti-tailbud supernatant was a different preparation from that shown in Figure 3.

In Figures 3-5, illustration A shows the enzyme stained planchet photographed with the dark field apparatus (Fig. 1), B shows the same planchet photographed with the transmitted light apparatus (Fig. 2) and C shows a protein stained planchet from the same diffusion plate photographed under the same conditions as B.

Although a large number of precipitation lines appeared in these patterns, only 1-3 lines took the stain for lactate dehydrogenase[2]. One of these lines, i.e. the stained line seen in Figure 5B, was produced by a non-precipitating antibody[1], but the others were associated with precipitation lines[2].

In the dark-field photographs (A of Fig. 3-5) the unstained, non-enzyme precipitation lines are visible as white lines on a dark background; in black and white photographs the stained enzyme lines can be distinguished from the background only where they interrupt unstained lines. Since transmitted light washed out the unstained precipitation lines, the technique used for illustration B of each figure records only the enzyme stained lines, with the exception of a few instances where very dense unstained precipitation lines are visible in such photographs. However, these can be washed out by appropriate filters.

Color photographs[1] are adequate to illustrate the essential features of these plates, but the dark-field black and white prints (A of Fig. 3-5) are adequate for the documentation of enzymes acting as antigens only when accompanied by prints of the same planchets produced with transmitted light (B of Fig. 3-5). Thus, the joint publication in black and white of the dark field and transmitted light photographs accomplishes the purpose of a single colored photograph.

Amido black was used to stain the "protein" planchets (C of Fig. 3-5). While amido black stains proteins and each line contains antibody protein, not all lines take this or any other single stain with equal intensity. This probably occurs because not all antigens are proteins, because of differences in the Ag/Ab ratios at optimal proportions and also because of the special characteristics of each kind of stain. Consequently, the amido black stained planchets show differences when compared with the dark field planchets from the same agar block. Thus, as seen in a comparison of Fig. 5A and Fig. 5C, the finer lines and terminal endings of heavy lines appear in the dark field illustration but are not clear in the pattern stained with amido black.

On the other hand, the stained figures show features which are distorted in dark field. For example, line x appears

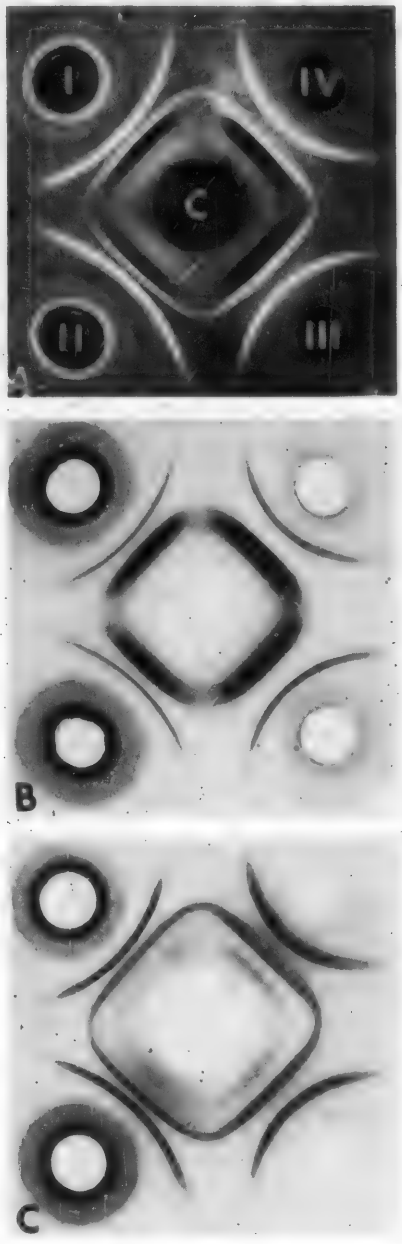

Figure 3. A. Dark Field and B. Transmitted light illustrations of a lactate dehydrogenase immunozymogram of a frog embryo and anti-embryo system. C. Transmitted light illustration of a second planchet from the same plate stained with amido black.

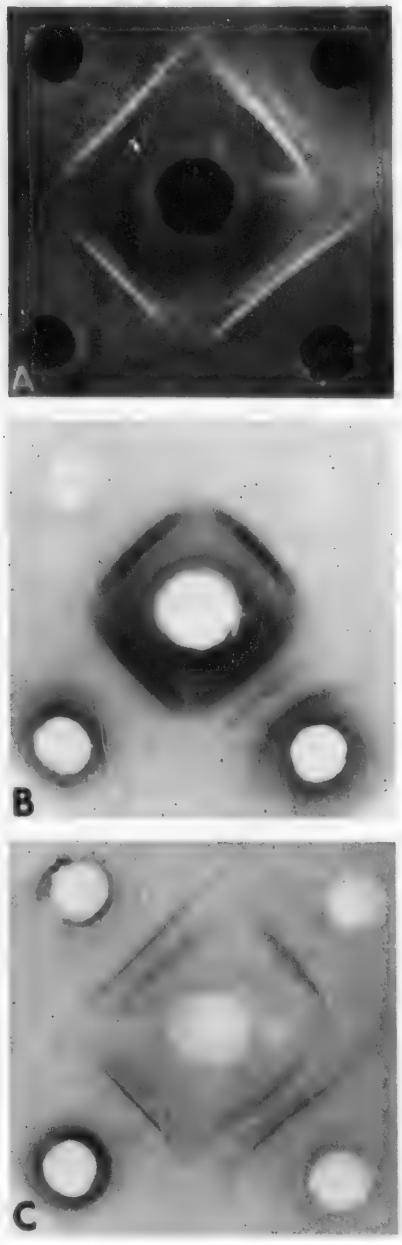

Figure 4. An immunozymogram of a frog kidney, tumor, embryo and anti-tumor system. A, B, and C as in Fig. 3.

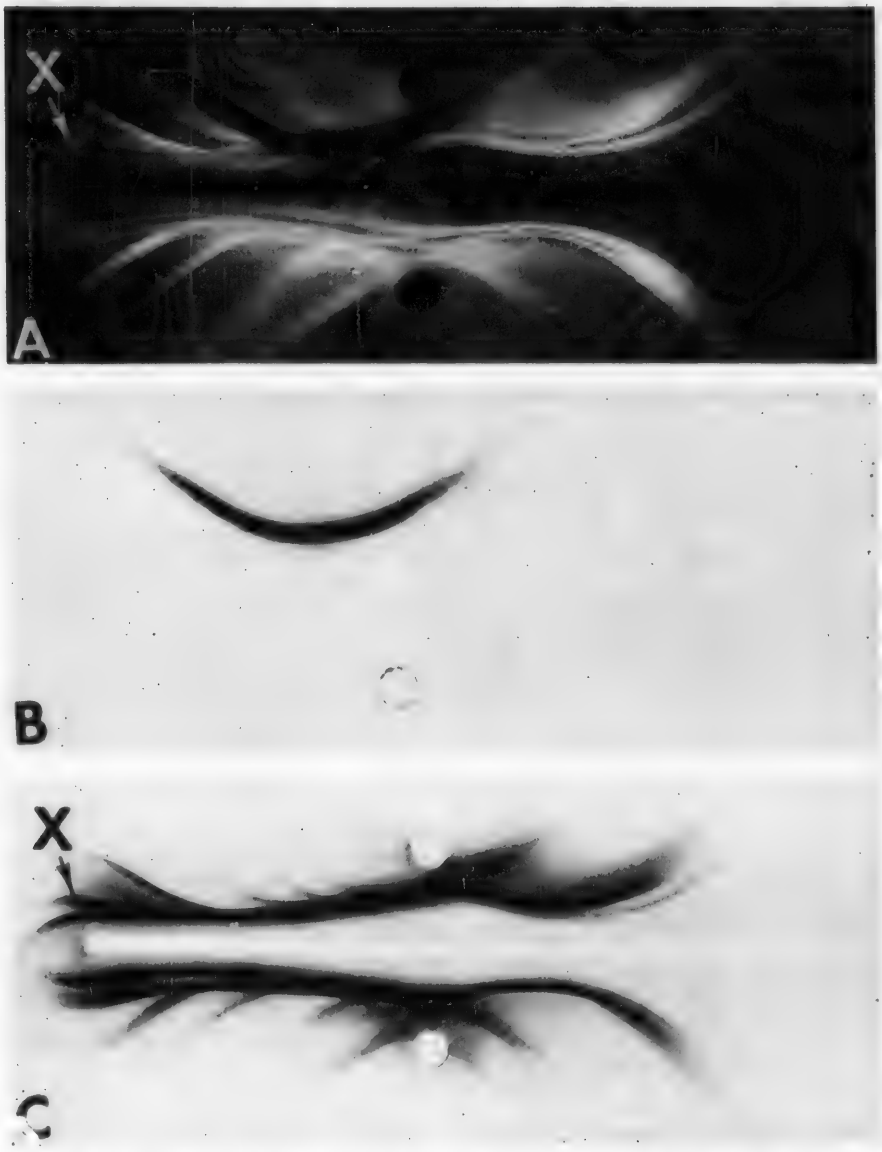

Figure 5. A lactate dehydrogenase immunoelectrozymogram of a frog embryo and anti-embryo system. A, B, and C as in Fig. 3.

solid in Fig. 5C but is split in Fig. 5A. The reason for this is that light from the dark field source does not completely penetrate very broad, dense precipitation lines. Thus, the particles in the two faces of such lines may be illuminated and recorded, whereas particles in the central region of the line are not illuminated. Therefore, the precipitation band appears as two parallel lines separated by a dark region.

These observations indicate that, even though the objective may not be the illustration of enzyme stained lines, the complete documentation of an agar diffusion pattern requires the use of both dark field and transmitted light figures.

Projection:

Oral presentations of agar diffusion data can be illustrated with lantern slides prepared from the negatives produced by the methods described above. It is more dramatic and less expensive, however, to present the original material. This can be done by pasting masking paper on a lantern slide cover and attaching the stained and dried agar diffusion planchet-slide preparations to the masking paper with scotch tape. There is room on a 3¼ x 4 slide for two or three such preparations. The planchets are protected by placing them toward the lantern slide cover. Neat, temporary labels are provided by coating the back of the planchet-slides with a thin layer of 1% agar; when dry, india ink labels can then be printed directly on this colorless agar.

Conclusion and summary:

The problem of illustrating serological agar diffusion patterns containing both stained and unstained lines is discussed in relation to transmitted light and dark field illumination techniques which have been published. The characteristics of the ideal technique are described.

A single apparatus suitable for both transmitted light and dark field illumination is described. It attempts to maximize photographic versatility and minimize complexity and cost. By using this equipment to make complementary dark field and bright field photographs of the same pattern, it is shown to be possible to adequately illustrate Ouchterlony type diffusion patterns or immunoelectrophoretic patterns containing both stained and unstained lines. Such complementary illustration circumvents the need for color reproduction and, in addition, shows characteristics of the patterns that could not be demonstrated by any other single technique.

REFERENCES

1. Nace, G. W. and T. Tachibana. Micro immunozymograms and the visualization of a non precipitating antibody. Immunol., in press.

2. Nace, G. W., T. Suyama, and N. Smith. The development of special proteins. Symposium of the International Institute of Embryology, September, 1960. (S. Ranzi, Ed.) In press.

3. Bartlett, E. C. 1961. A simplified method of recording agar diffusion plates. J. Biol. Phot. 29: 7-10.

4. Wilson, M. W. and B. H. Pringle. 1956. Cross reactions in the Ouchterlony plate: Analysis of native and halogenated bovine serum albumins. J. Immunol. 77:324-331.

5. Lawson, D. F. 1960. Photographing precipitation bands. J. Photo. Sci. 5:1-4.

6. Ouchterlony, O. 1958. Diffusion-in-gel methods for immunological analysis. Prog. Allergy. 5:1-78.

7. Schutz, J. N. 1958. Dark field illuminator for petri dish photography. J. Biol. Phot. 26:159-164.

8. Jackson, R. 1959. Photographing precipitation bands in agar gel plates. J. Biol. Phot. 27:133-138.

9. Klontz, G. W., G. J. Widgeway, G. P. Wilson. 1960. An illuminator for observing and photographing precipitin reactions in agar. J. Biol Phot. 48:11-14.

10. Lawson, D. F. 1960. *The Technique of Photomicrography*. 1st ed. George Newnes Limited. London, England.

11. Murchio, J. C. 1960. Photography of agar-gel diffusion microslides. J. Biol. Phot. *28*:65-68.

12. Wilson, M. W. and B. H. Pringle. 1951. Experimental studies of the agar-plate precipitin test of Ouchterlony. J. Immunol. *75*:252-258.

13. Grasset, E., F. Pongratz and T. Brechbuhler. 1956. Analyse immunochimique des constituents des venins de serpents par la méthode de précipitation en milieu gélifié. Ann. Inst. Past. *91*:162-186.

14. Wadsworth, C. 1957. A slide microtechnique for the analysis of immune precipitates in gels. Int. Arch. Alleg. and Appl. Immunol. *10*:355-360.

15. Crowle, A. J. 1958. A simplified micro-diffusion agar precipitin technique. J. Lab. and Clin. Med. *51*:784-787.

16. Grasset, E., V. Bonifas, and F. Pongratz. 1958. Rapid slide precipitin microreaction of Polyomyelitis antigens and antisera in agar. Proc. Soc. Exper. Biol. and Med. *97*:71-77.

17. Mansi, W. 1958. Slide-gel diffusion precipitin test. Nature. *181*:1989-1990.

18. Uriel, J. and P. Grabar. 1956. Emploi de colorants dans l'analyse electrophoretique et immuno electrophoretique en milieu gélifié. Ann. Inst. Past. *90*:127-140.

MAILING TO ENGLAND

In the past it seemed quite difficult to bring or mail materials, such as prints, photographs and movies, into the United Kingdom for purposes of exhibiting or as proof for Associateship and Fellowship of the Royal Photographic Society (for example).

The following I have taken out of the May, 1961 Vol. 101, No. 5 of the Photographic Journal of the Royal Photographic Society (of which I am a member since beginning of this year) *for the information of our membership especially since the coming of the Second International Congress of Medical Photography and Cinematography will take place in England in 1963:*

CUSTOMS PROCEDURES

New arrangements have been made by Her Majesty's Customs and Excise to facilitate the Royal Photographic Society's temporary importation of prints, transparencies and kine film. Anybody sending work from abroad for exhibition, selection or in support of an Associateship or fellowship application is asked to note that the outside wrapper of the package should be marked: **"B. O. 10623/61"** and **"For exhibition"** or **"Evidence supporting application for Associateship (or Fellowship)"** as the case may be.

New Products

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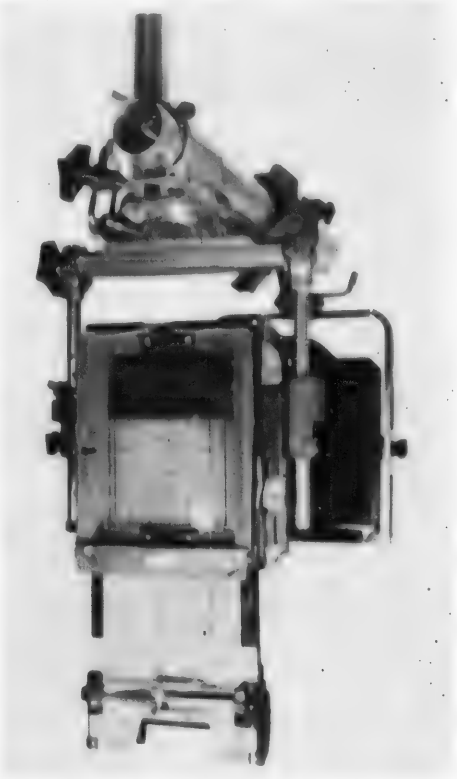
In addition to the well known line of Super CAMBO studio cameras manufactured by [illegible] N.V. in Holland, Kenneth Brooks Inc. is also distributing the complete line of CAMBO [illegible] including the new simple but very sturdy wall carrying case. This sturdy all metal model stand already has replaced the wood types wherever budget combination widely used for overhead shooting, especially as the stand becomes as low as 6" and easy to handle and avoids camera movement problems. It packs into a convenient carrying bag for easy portability for field use where its utility is unsurpassed. Disassembles into 3 sections, and permits camera use at heights from 3" to 10'. List price $289.50 (case extra).



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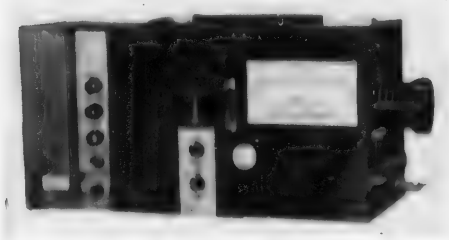
If both groundglass and filmholder frame are removed, the SINAR Rapid Adapter for 2 1/4x2 1/4 and 2 1/4x3 1/4, or a lensboard with adapter for the ALPA 35mm Single lens Reflex camera can be attached.

Dist.: Karl Heitz, Inc., 480 Lexington Avenue, New York 17, N.Y.



KALART INTRODUCES "SOUNDSTRIP" . . . NEW SOUND SLIDEFILM PROJECTION PROCESS

The first "Talking Still Picture" projector was demonstrated today to the National Convention of the Department of Audio-Visual Instruction, N.E.A., meeting in Miami Beach.

This new device called SOUNDSTRIP by its producers, The Kalart Co., Inc., of Plainville, Connecticut, utilizes a rotating light beam to scan an optically recorded sound track on a still picture filmstrip.

A SOUNDSTRIP program produced on standard 35mm motion picture film (either color or black-and-white) contains a series of pictures arranged alternately with recorded sound messages in synchronized relationship. As each picture is projected on a screen its related sound message is scanned and reproduced through a built in amplifier and speaker. Each sound message can contain up to 18 seconds (or less) of program time, and at the end of each message the film automatically advances to the next picture and sound frame.

Additional features designed into the Kalart SOUNDSTRIP Projector permit the operator to interrupt the program at the end of any recorded message to add his own remarks about the program and to repeat any picture and its related sound message. He may also skip any portion of the film he does not wish to present, or to rewind and review any portion. All of these features are combined with positive synchronization of each picture frame with its related sound frame.

In addition to projecting "SOUNDSTRIP" sound on-film programs, this new projector can also show existing single-frame silent (captioned) filmstrips and with an accessory slide changer can project standard individually mounted 35mm slides.

Kalart has demonstrated its new SOUNDSTRIP Projector to important users of sound slidefilm programs in Education, Industry and Government, several of whom are now testing SOUNDSTRIP programs for training, promotion and self-study. Additional information may be obtained by writing directly to Kalart at Plainville, Connecticut.

ANSCO INTRODUCES VEECEE PROJECTION PAPER

VeeCee, a medium speed, variable contrast projection paper with unique image qualities and outstanding processing flexibility, has been announced by Ansco, the photographic manufacturing division of General Aniline & Film Corporation.

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Increased emphasis on Specialized and Scientific Photographic Equipment makes this latest catalog from Burke & James of real value to the Industrial and Scientific, etc., photographer. Micro and macrophotography cameras for pathology, copying equipment, as well as complete listings of "LENS BANK" services and lenses, and laboratory and dark room needs, temperature control systems are only a few of the equipment categories covered.

148 pages long, this is the biggest, most complete catalog ever published by Burke & James. The 64th Annual Catalog from this supplier, is a valuable reference source for the photographic specialist. Available on request. Write: Burke & James, Inc., 321 South Wabash, Chicago 4, Illinois.

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Superior craftsmanship in still or motion picture photography of biological subjects.

Ability in photographic research in new methods or materials.

(These require submission of evidence.)

Meritorious contributions to biological photography overall through sustained organizational work.

Two sponsors are required. The sponsors should be well acquainted with the candidate's work and ready to furnish the Board with details of his experience and achievements. Those who wish to sponsor a member whom they believe to be eligible should request a Fellowship Application form from the Secretary of the Fellowship Committee: Mrs. Maria Ikenberg, University of Illinois, 904 W. Adams Street, Chicago 7, Illinois.

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QUARTERLY OF THE BIOLOGICAL PHOTOGRAPHIC ASSOCIATION, INC.

Volume 29, Number 4 November, 1961

JOURNAL *of the* BIOLOGICAL PHOTOGRAPHIC ASSOCIATION

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Journal of the Biological Photographic Association Vol. 29, No. 4 November, 1961

High Speed Photography of Mandibular Fractures*

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The University of Michigan Medical School, Ann Arbor, Michigan

Introduction

IN order to better understand fractures of the facial skeleton, a project was initiated several years ago which involved clinical and experimental studies. Detailed studies, thus far, have been focused on the lower jaw in an attempt to determine the biomechanics of fracture production.[1,2,3] To answer the question, "How does the mandible fracture?" engineering principles involving stresses and strains, impacts, energies, and forces had to be dealt with; consequently, engineering techniques had to be employed. The techniques were non-destructive testing procedures using a brittle strain sensitive lacquer — Stresscoat* — and strain gages.

When some of the early finds were presented to medical and dental groups, the results were not easily comprehended by them, for these groups, in general, are neither familiar with these testing methods nor the interpretation of the results. Therefore, as a dramatic corollary to our non-destructive tests, and to increase our understanding of the mechanisms of bone fracturing, high speed cinematography was employed. As far as we have been able to ascertain, no one up to this time has actually seen a bone break, that is, at speeds slow enough to accurately determine the mechanism in the production of bone fractures.

Materials and Methods

Test Specimens

Human mandibles were used in all tests. The size, state of dentition, or method of post-mortem handling (degreasing, bleaching, etc.) of the bones were not criteria in the selection of test specimens. Some were cleaned, degreased, and bleached, whereas others were not. All stages of dentition were also represented in the various specimens.

Cameras

The cameras used in this study were an Eastman Kodak High Speed** and a Wollensak "Fastax" WF1.*** Both cameras hold 100-foot rolls of 16 mm. film. The Eastman camera is capable of running up to a speed of 3,000 frames per second (fps) at standard line voltage 120 volts. The Fastax, when used with the Power Control Unit, can reach 16,000 fps. Using a mask, the frame size in the latter camera was 8 mm. single

* STRESSCOAT, Magnaflux Corporation, Chicago, Illinois.

* This investigation was supported by research grant D-895C1&2 from the United States Public Health Service, National Institute of Dental Research.

** Presently made by Beckman and Whitley, San Carlos, California.

*** Wollensak Optical Company, Rochester 21, New York.

width, whereas with the Eastman, results were obtained on full 16 mm. frames. In some of the tests a second Wollensak Fastax camera model WF17-T was also used.

Film, Lights, and Accessory Equipment

In the tests, 100-foot rolls of Kodak Tri-X, Negative (ASA Rating—250), 16 mm. film was used. In order to record the action at maximum or near maximum camera speed, the event-camera time interval was carefully calculated. Six, 750-watt Kenrod Photo Flood lights were used as the light source. Each light was adjusted separately so as to get maximum subject illumination.

A Wollensak WF-301 Fastax Power Control Unit, with timing units, one for the camera and one for the event, was used to combine the Fastax camera and the event (Fig. 1). When a second Fastax camera was used, it was controlled through its own Power Unit which was connected to the other Unit. This arrangement was as follows: the solenoid switch was attached to the event timer and one Fastax to the camera timer of one Power Unit. The starter button of this Unit was removed and replaced by a connecter which was attached to the second Power Unit through the event timer. The camera timer of this Unit was connected to the second Fastax camera. The start-button of the second Unit activated the solenoid switch and both cameras (Fig. 2).

The jig apparatus consisted of a heavy bench vise, mounted on a steel plate which was securely fastened to a two inch thick wood panel, measuring 3 x 3 feet. Side views of each specimen were obtained by a bent ferro-type plate mounted behind the vise (Fig. 2). A drop tube, four feet in length, permitted accurate impact points, and through it passed the one inch diameter steel rod, weighing three pounds. A solenoid switch connected to the Power Unit provided the automatic release mechanism for the bar. The energy applied to the jaw varied between 6 and 12 foot pounds. A gray card was placed behind the test specimen for better contrast between the bone and the background.

Procedure

Each mandible was securely mounted in a bar of Woods metal, a low temperature alloy, so that a line between the point of the chin and the condyles was perpendicular to the base plate itself. This was then securely fastened into the jaws of the vise. The drop tube was orientated so that the impactor hit squarely on the point of the chin.

The sequence of events for one run were correlated by means of a countdown, during which time the lights were turned on, the Eastman camera started, and finally the Fastax camera(s) and event sequence initiated. Immediately after the drop was completed the fractured mandible and all fragments were placed in a properly labeled envelope for study at a later time. The Eastman camera was used for full view recording —the mandible and its two mirror images; the Fastax (WF1) recorded a close-up of the chin area, while the other Fastax, when used, was focused on the right condylar area.

Camera Speed

The Eastman camera speed was near maximum on all tests (2,680-3,000 frames per second). After some early testings, the calculations for the event-camera time delay for the Fastax camera (WF1) gave near top film speed (12,000-15,000 frames per second). When both Fastax cameras were used, the calcula-

Figure 1. Power Control Unit as used for synchronization of the camera with the event.

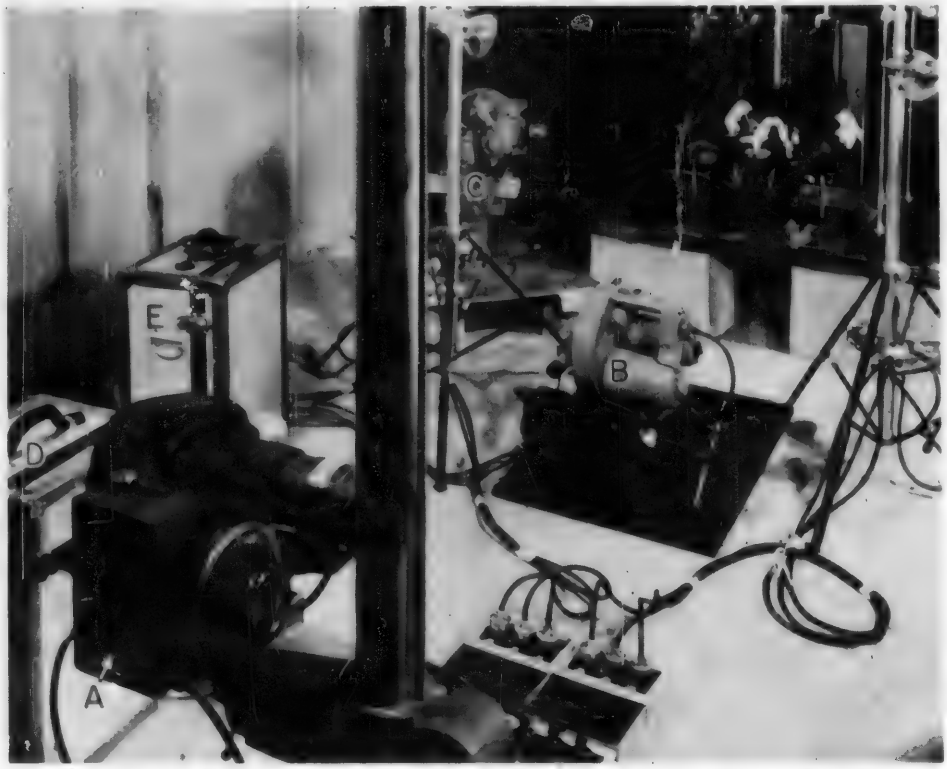

Figure 2. Positional arrangement of testing and recording equipment. Camera A – Eastman Kodak High Speed; Cameras B and C – Wollensak Fastax models WF1 and WF17-T respectively; D and E – Wollensak Power Control Units. Note the bent ferro-type plate behind the bone which was used to visualize side views of the specimen.

tions needed to be more critical in that here both cameras had to be started at different times, and the event initiated. However, maximum speed on the WF-17-T camera (6,000 fps) was obtained with near maximum speed, as above, on the other Fastax camera (WF1).

Discussion

Some 50 mandibles were fractured in front of the high speed cameras. From these tests a 15-minute movie entitled, "The Production of Mandibular Fractures," has been produced.[4] This completed film utilized only the all over view of the Eastman camera. For effect, a test, taken with a 16 mm. movie camera* at 16 fps, was used at the very beginning of the film. Here the action and resulting fracture occur so fast that the entire event cannot be perceived. Following this, high speed film strips are then used. The difference in the speed of the events is dramatically shown, and in this way, the value of high speed cinematography is quickly noted by the audience. In the film each high speed test is repeated three times.

The advantages of using high speed cinematography are: 1. To actually see

*Cine Special, Eastman Kodak, Rochester, New York

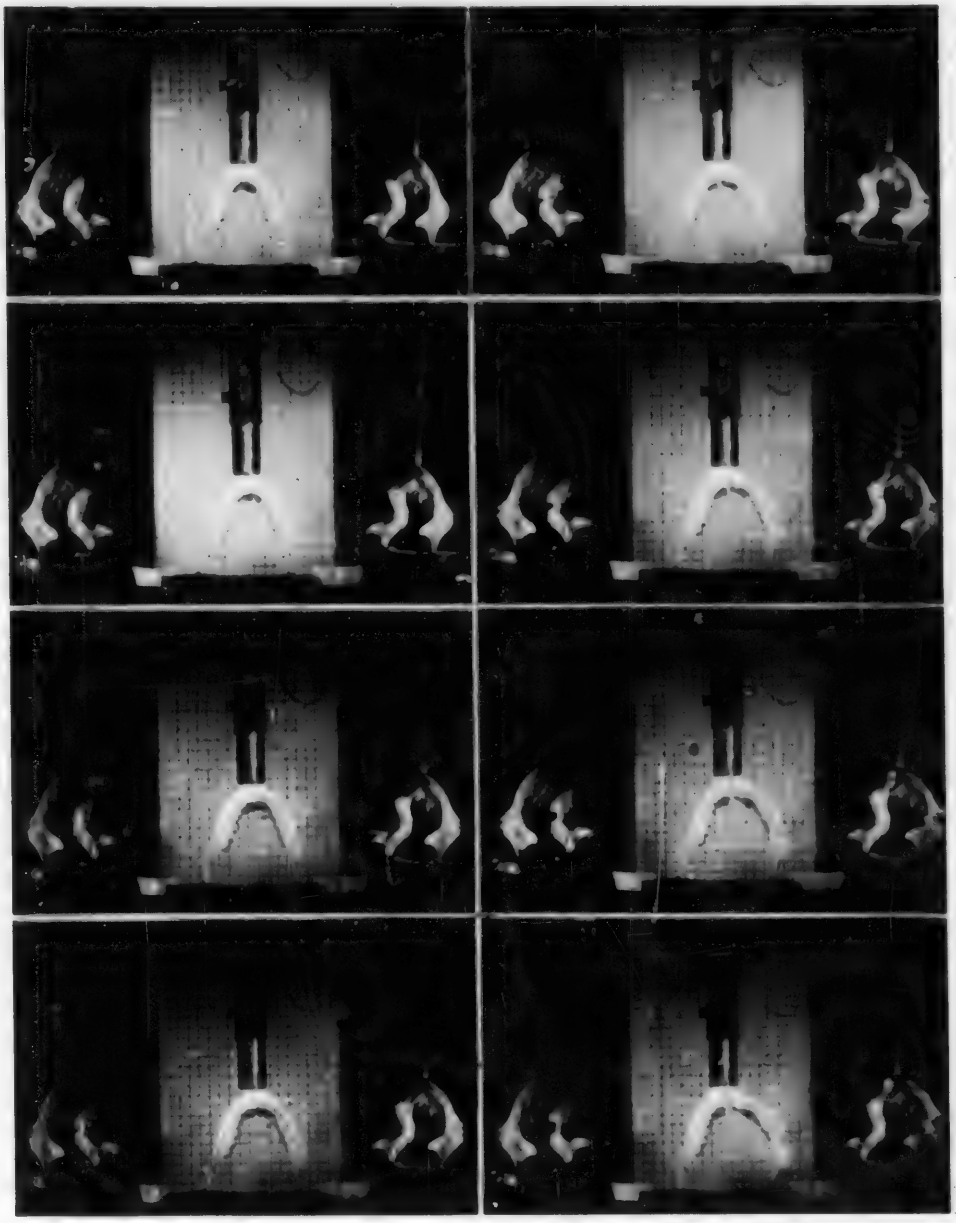

Figure 3. Full view of mandibular fractures (test 44), 3,000 frames per second.

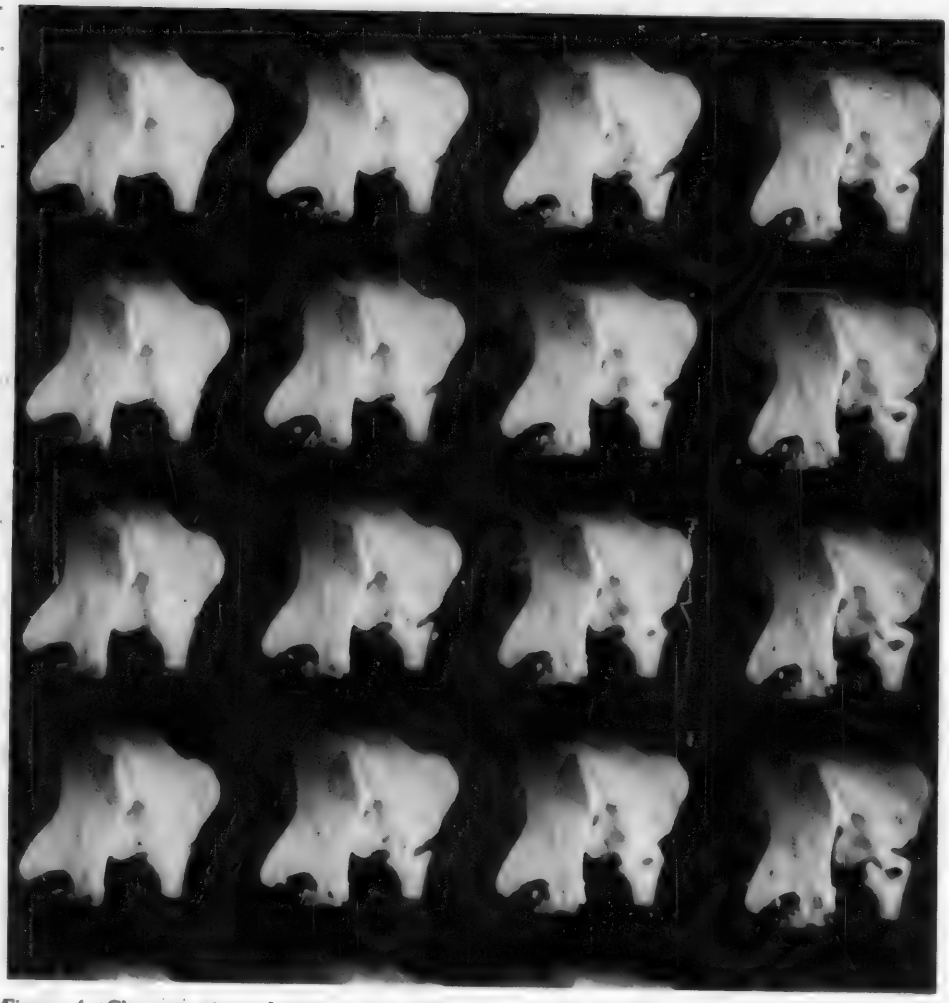

Figure 4. Close-up view showing subcondylar fractures (test 47).

Figure 5. Fracture production on the inner aspect of the inner mandible (test 54), 12,480 frames per second.

the production of the fractures, an event which otherwise occurs too fast for the eye to perceive. By "slowing down" the action in high speed photography, one can repeatedly study the event. 2. As a dramatic presentation to clinicians to indicate the amount of deformation of the bone at impact, this technique is unsurpassed. By projecting the films at silent film speed (16 fps) and, for presentation, repeating the same event three consecutive times, one can concentrate on a different area of the picture each time to see the specific details therein. 3. To correlate and to reinforce the non-destructive testings, high speed cinematography has proved to be of value. The non-destructive tests indicate the high tensile strain areas, that is, the areas where failure (fracture) of the material would occur if the energy of the impact were sufficient. With fracturing impacts and high speed photography one can see these specific areas fracture, and from the film records a study of the mechanism of fracturing can be carried out.

The technique of high speed cinematography, as applied here, has been highly successful. Because of its usefulness, it is being applied to other areas in the study of biomechanics in our laboratory.

Conclusions

1. A new use for high speed cinematography is described. Using human mandibles with fracture producing impacts, one can readily visualize the method of failure of the bone.

2. Utilizing this technique in bone biomechanics adds to our understanding of the mechanisms involved in fracture production and substantiates the results obtained by other testing procedures.

BIBLIOGRAPHY

1. Hagen, E. H. and Huelke, D. F.: An analysis of 319 case reports of mandibular fractures. J. Oral Surg., Anesth. and Hosp. Dent. Serv. 19:93-104, 1961.
2. Huelke, D. F.: Mechanisms involved in the production of mandibular fractures. A study with the "Stresscoat" technique. (1.) Symphyseal impacts. J. Dent. Res. 40:1042-1056, 1961.
3. Huelke, D. F., Burdi, A., and Eyman, C.: Mandibular fractures as related to site of trauma and state of dentition. J. Dent. Res. 40:(Nov.-Dec.) 1961.
4. Huelke, D. F.: The production of mandibular fractures (Symphyseal impacts). 15 min. movie, 1960.

NOW IS THE TIME

Parties who intend to give attention to lantern exhibitions during the coming autumn and winter, should be warned not to put off their preparation work, rehearsals, etc., too long. The cause of a great many failures is the going into the field without experience and ample preparation. As intimated by a correspondent on another page, no one has a right to go before an audience without proper experience, and expect to give satisfaction; and apparatus badly worked, and slides arranged in a slovenly manner, will result in your receiving the cold shoulder the next time you come around, and you will deserve it.

Excerpt from "The Magic Lantern," August, 1878

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Simplified λ365mμ Photomicrography with Improved Results*

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History

THE original investigation by Trivelli and Loveland[1] of the use of the near-ultraviolet region for photomicrography showed the improved resolution possible with the near-ultraviolet. This was followed by the commercial introduction by the Bausch and Lomb Optical Company of a series of objectives spherically corrected for λ365mμ and achromatized for λ365mμ and λ546mμ. Although the method was capable of producing images superior to that with blue (λ436mμ) light, it received no general acceptance from photomicrographers, and the Bausch and Lomb objectives were soon dropped from production.

There were many reasons for this lack of acceptance: Special objectives useful only for λ365mμ were needed. A special immersion fluid was required. The immersion objective was not perfectly achromatized, and this necessitated a focus correction from the very poor quality visual green image to obtain a good ultraviolet focus. The optimum tube length was not always the specified 160mm, requiring a photographic determination of the optimum. The theoretically possible improvement in resolution was small (from 0.17μ at λ436mμ to 0.14μ at λ365mμ). Incorrect usage often produced inferior negatives. For most photomicrographers, the results did not warrant the expense of the additional equipment nor the trouble of adopting an exacting method.

After Spinell and Loveland[2] had determined the extent to which spherical aberration introduced by incorrect object-space conditions could be eliminated by simple mechanical adjustment of the tube length, it was apparent that excellent negatives could be obtained at λ365mμ with a conventional apochromatic objective by adjusting the tube length. Such a procedure eliminates the need for special optics and special immersion fluids, and it fits into a photomicrographic routine without causing a complete disruption of that routine.

Optimum Tube-Length Tests

A 2mm apochromatic objective, N.A. 1.3, was selected for the test for these reasons:

1. Apochromats are generally spherically corrected for the green and blue region. Hence, the tube-length adjustment needed to correct spherically for the near-ultraviolet region should be less than for an achromat which is spherically corrected only for the green. A most important concomitant of this situation is that, since the difference in optimum tube

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lengths between ultraviolet and blue wavelengths is small, a very high quality blue image is obtained for visual focusing.

2. Such a high-aperture objective provides not only the most sensitive test but also the most practical one. The near-ultraviolet is used because it affords slightly higher resolution and often a desired differential absorption. If this high-aperture objective could be used successfully, then certainly lower-aperture objectives could also be used. However, the lower-aperture objective would probably be used only for differential absorption studies.

The optimum tube length for this objective at $\lambda 365 m\mu$ was determined photographically. Photomicrographs were made using tube lengths differing by increments of 10mm until the optimum had been bracketed. Additional photomicrographs were made using 5mm tube-length changes on both sides of the apparent optimum. Image distance was adjusted for each tube-length change to maintain a magnification of 2500×. Four negatives were exposed at each tube-length setting. A very slight ($1/4\mu$) focus change was made between each negative. One interesting fact was observed: The ultraviolet focus was $2\frac{3}{4}\mu$ outside the blue focus, irrespective of tube length. The optimum tube lengths for the blue and green were then determined using the "star test."[2] The tube length for the blue as indicated by the star test was confirmed photographically. The results were so unexpected that a second test was made using a second objective of the same manufacturer. The first objective is approximately 15 years old; the second is new. As can be seen in Table I, tube length is independent of wavelength.

A second set of star tests was run with both objectives, using a 25× compensating ocular. A wavelength-dependence greater than the tube-length tolerance established photographically with the 15× ocular was found, so no further testing was done with the 25× ocular.

Since many photomicrographs are made using uncovered preparations, an additional test was run to determine the optimum tube length for preparations without a cover slip. As expected, the optimum tube-length difference between the blue and the ultraviolet was small enough to be ignored for most purposes. A 5mm change from optimum in tube length produces a barely detectable image degradation. The two tube lengths were only 5mm apart (see Table II for these results).

Magnification

Of interest to the photomicrographer is the change in magnification due to a change in wavelength, i.e., lateral and/or longitudinal color. A four-point photographic magnification calibration (i.e., magnification *vs.* image distance) was made, the older objective and the 15× compensating ocular being used for both the blue and ultraviolet radiation. The magnification range was from 2200× to 2900×. No effect of wavelength on magnification could be measured. The accuracy of measurement was better than 1/4 of 1 percent.

Practical Comparisons

A series of photomicrographs of the same field were then made using the manufacturers' specified tube length, the empirically determined optimum tube length for the existing condition, blue light and ultraviolet radiation (Table III), with and without a cover glass. As can be seen from an examination of the

TABLE I

Optimum Tube Length for Green, Blue, and Ultraviolet Radiation

Objectives: 2mm Apochromats, Bausch and Lomb.
Ocular: 15× Compensating Bausch and Lomb (new design).
Substage Condenser: Leitz Aplanatic-Achromatic N.A. 1.40.
Light Source: General Electric C-3 H85 Mercury Arc.
Filters: λ546mμ — Kodak Wratten Filter No. 77A.
λ436mμ — Kodak Wratten Filter Nos. 34 + 2A + 38A.
λ365mμ — Kodak Wratten Filter No. 18A.
Test Object: Star test — aluminized slide with pinholes.
Photographic — fine-grain silver halide dispersed in gelatin.
Immersion Oil: Crown.
Cover slip: Corning No. 1½, 0.18mm thick.
Room Temperature: 24°C.

	Optimum Tube Length	
Wavelength (mμ)	*Old Objective* (mm)	*New Objective* (mm)
546	130	150
436	130	150
365	130	150

*Optical contact between the cover slip and the test object was made with Crown Oil.

photomicrographs (Figures 1-9), the ultraviolet photomicrographs taken with the apochromat set at the optimum tube lengths are of the highest quality. The very slight superiority of these photomicrographs over the one taken with the special λ365mμ achromat may not be as clear in the halftone reproduction as it is in the original photomicrographs. Figure 5 was omitted from the reproduction since no difference could be detected between it and Figure 6. The 10mm tube-length difference between these two was obviously within the tolerance for tube length. Figures 4 and 6 are, as expected, of the same quality. This quality is definitely lower than that of the preceding ultraviolet photomicrographs. Comparison of Figures 7 and 6 and of Figures 9 and 8 shows the superiority of ultraviolet over the blues, even with an incorrect tube length.

Additional Useful Information

Several factors about near-ultraviolet photomicrography which are quite relevant have not been mentioned in the main text of this paper, since they are the result of accumulated experience rather than of factors specially determined. Illumination from the mercury arc used as a light source is somewhat diffuse. This undoubtedly contributes to the lack of sensitivity of the system to lamp condenser focus. An ordinary, uncorrected, double spectacle-lens type of lamp condenser is used. It has been found quite satisfactory to focus the con-

TABLE II

Optimum Tube Length for Green, Blue, and Ultraviolet Radiation

Objectives: 2mm Apochromats, Bausch and Lomb.
Ocular: 15 × Compensating Bausch and Lomb (new design).
Substage Condenser: Leitz Aplanatic-Achromatic N.A. 1.40.
Light Source: General Electric C-3 H85 Mercury Arc.
Filters: λ546mμ — Kodak Wratten Filter No. 77A.
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λ365mμ — Kodak Wratten Filter No. 18A.
Test Object: Star test — aluminized slide with pinholes.
Photographic — fine-grain silver halide dispersed in gelatin.
Immersion Oil: Crown.
Room Temperature: 24°C.

Wavelength (mμ)	*Optimum Tube Length*	
	Old Objective (mm)	*New Objective* (mm)
546	165	195
436	150	180
365	145	(not determined)

denser for the blue light whether green, blue, or near-ultraviolet radiation was used. If it is desired to check the actual ultraviolet focus, a white handkerchief, or other white cloth, laundered in a modern detergent, will provide an excellent fluorescent screen.

Achromatic substage condensers of several manufacturers including Bausch and Lomb, American Optical, Leitz, and Watson have been used for near-ultraviolet photomicrography. All these condensers have sufficiently good chromatic correction so that a good blue focus is also a good near-ultraviolet focus. Again, this is easy to check as most people have sufficient visual sensitivity to λ365mμ to be able to check the focus of a substage condenser simply by observing an illuminated field previously focused in the visible blue. Obviously, Köhler-type illumination is inferred.

Photographic materials for near-ultraviolet photomicrography should not be chosen on the basis of published data for exposure indexes or gammas, since higher speeds and lower gammas than these are usually obtained. As a general rule, one should select either ordinary (unsensitized) or orthochromatic material, although some panchromatic materials may be suitable. Some materials may contain emulsion addenda which limit the gamma and density of an ultraviolet negative to unsuitably low values.

Summary

Use of Crown Immersion Oil, a Corning No. 1½ cover glass, a Bausch and Lomb 2mm apochromatic objective, and

TABLE III

Photographic Test of Simplified Method. Data for Figures 1 through 9

Light Source: General Electric C-3 H85 Mercury Arc.

Filters: λ436mμ — Kodak Wratten Filter Nos. 34 + 2A + 38A.
λ365mμ — Kodak Wratten Filter No. 18A.

Photographic Material: Kodak Contrast Process Ortho Film.

Exposure Time: λ436mμ — 8 sec.; λ365mμ — 4 sec.

Development: λ436mμ — 2½ minutes in Kodak DK-50 at 20°C.
λ365mμ — 4 minutes in Kodak D-19 at 20°C.

Gamma: 2.5.

Substage Condenser: Leitz Aplanatic-Achromatic, N.A. 1.4.

Objectives: Bausch and Lomb 1.7 Special λ365mμ Achromat.*
Bausch and Lomb 2mm Apochromat.

Ocular: Bausch and Lomb 15 · Compensating (new type)

Sample: Silver halide dispersion.

Cover Glass: Corning No. 1½, 0.18mm thick.

Immersion Oil: For Apochromat — Crown Oil.
For λ365mμ Achromat — Sandalwood Oil.

Magnification: 2500×.

Figure	*Objective*	*Wavelength*	*Tube Length (mm)*	*Cover Glass*	*Focus Correction*
1	λ365mμ Achromat	365mμ	140	No	+ 3μ
2	2mm Apo	365mμ	130	Yes	— 2¾μ
3	2mm Apo	365mμ	145	No	— 3¾μ
4	2mm Apo	436mμ	130	Yes	None
5	2mm Apo	436mμ	150	No	None
6	2mm Apo	436mμ	160	No	None
7	2mm Apo	365mμ	160	No	— 3¾μ
8	2mm Apo	436mμ	160	Yes	None
9	2mm Apo	365mμ	160	Yes	— 2¾μ

*This objective was designed for λ365mμ photomicrography. It was specially corrected by the manufacturer for use without a cover slip. Although 160mm was the design tube-length, the optimum tube-length was found to be 140mm.

Photomicrographs of silver halide dispersion demonstrating quality obtainable with method described. Magnification, 2500×. (See Table III for complete details).

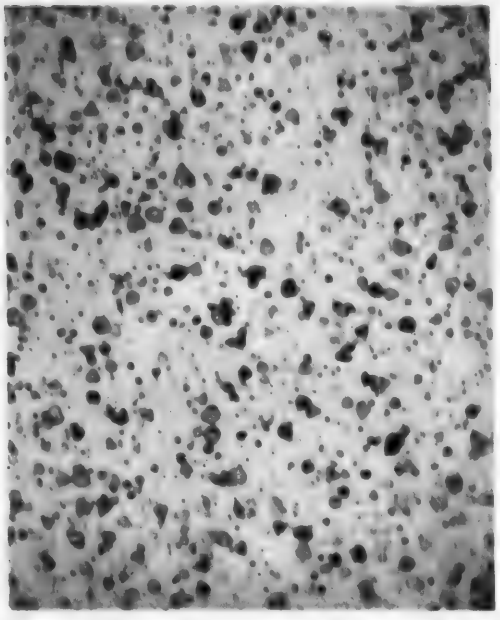

Figure 1. Special achromat at optimum tube length. λ365mμ. No cover glass.

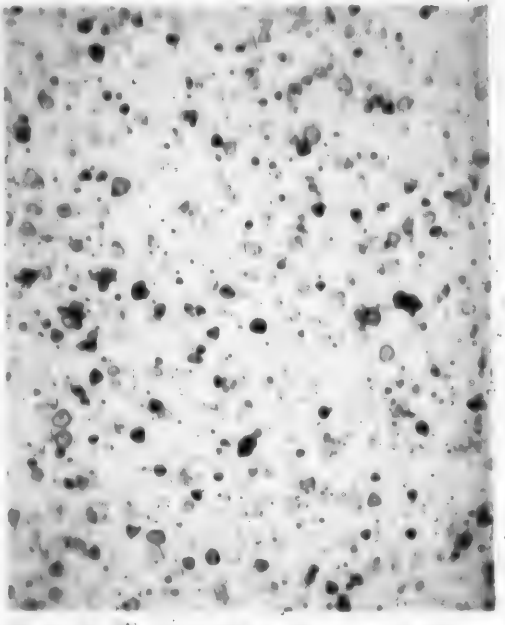

Figure 2. Conventional apochromat at optimum tube length. λ365mμ. With cover glass.

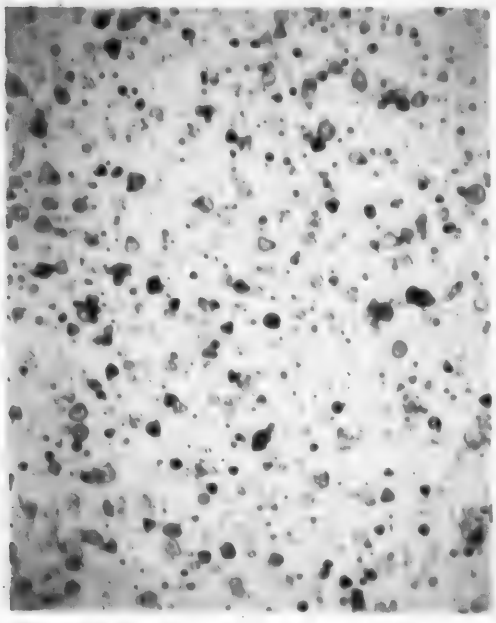

Figure 3. Apochromat at optimum tube length. λ365mμ. No cover glass.

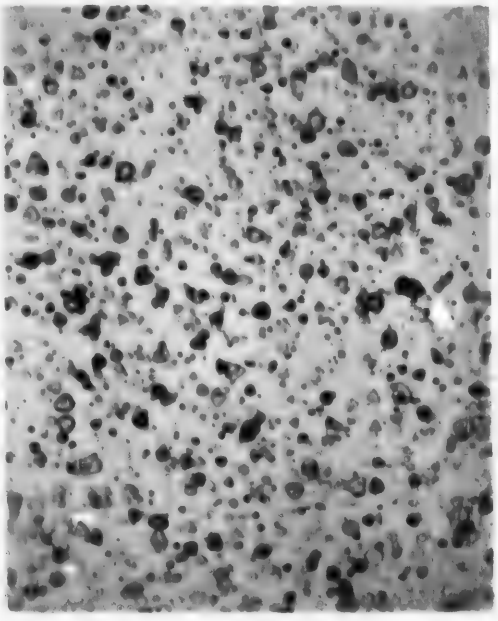

Figure 4. Apochromat at optimum tube length. λ436mμ. With cover glass.

Photomicrographs of silver halide dispersion demonstrating quality obtainable with method described. Magnification, 2500×. (See Table III for complete details).

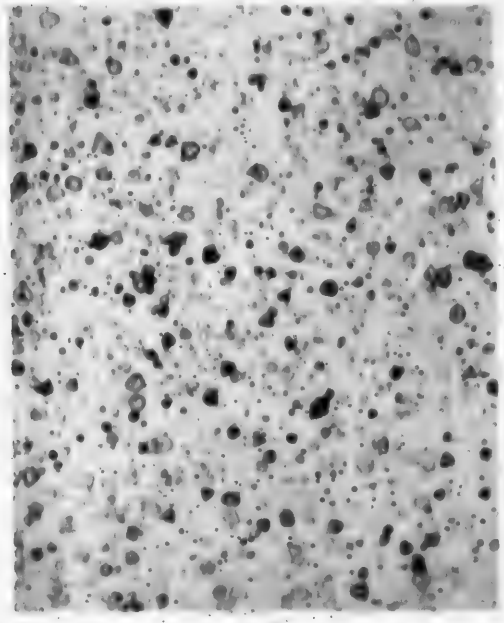

Figure 6. Apochromat at standard tube length. λ436mμ. No cover glass. [Fig. 5 omitted, see text.]

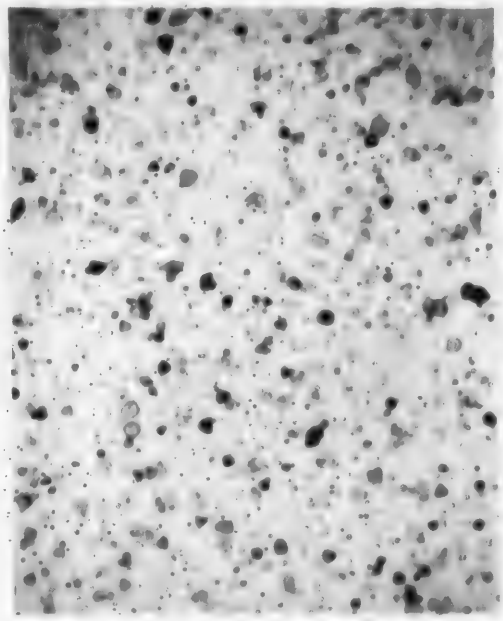

Figure 7. Apochromat at standard tube length. λ365mμ. No cover glass.

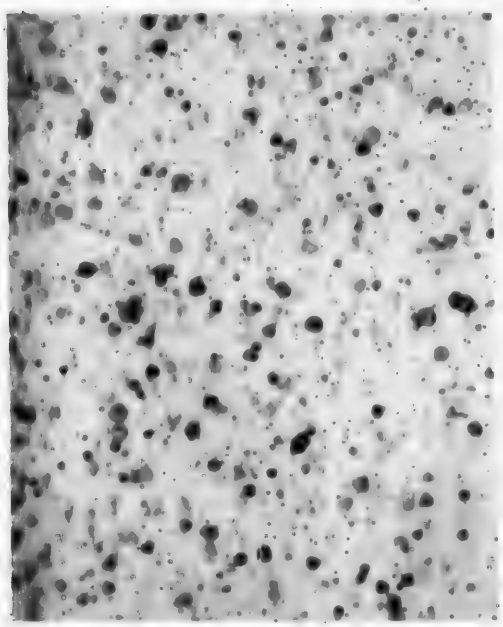

Figure 8. Apochromat at standard tube length. λ436mμ. With cover glass.

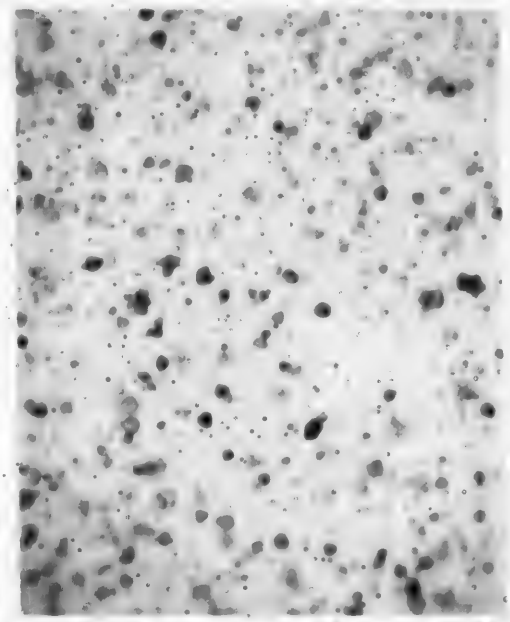

Figure 9. Apochromat at standard tube length. λ365mμ. With cover glass.

a 15×, compensating ocular at the optimum tube length will enable the photomicrographer to make photomicrographs in either the blue or the near ultraviolet region by simply changing to the appropriate light filter and exposure time. For the ultraviolet, the fine focus is raised $^{3}/_{4}\mu$ from the best blue focus.

Optimum tube length for λ365mμ will be the same as that for the blue (λ436mμ). The optimum for the blue can be quickly determined by the star test. Magnification with λ365mμ will be the same as for the blue (λ436mμ).

The method is greatly simplified if preparations are covered with the recommended cover slip. Many uncovered preparations can be covered by the simple process of pressing a cover slip into a small drop of objective immersion oil placed on the preparation. If uncovered preparations must be used, a small decrease in the tube length from that for blue light is required for the best results in the near ultraviolet.

Following the procedure described will produce near ultraviolet photomicrographs superior to those obtained with an objective specially designed for near ultraviolet photomicrography.

It is not known whether these results will be obtained with apochromats and 15× compensating oculars of other manufacturers. These results will not be obtained with achromats or fluorites.

Cover slips, such as Corning, with an $n_D = 1.531$ must be used. This high refractive index is an important factor in obtaining the spherical correction. A cover slip of lower refractive index will cause a differential of optimum tube lengths over the wavelength range tested. An extreme case of this is the use of the uncovered objects (Table II).

The use of λ365mμ is recommended only for those cases where the highest resolution obtainable with glass optics is required or for differential absorption. It is not suggested that it be used to replace visible light photomicrography.

BIBLIOGRAPHIC REFERENCES

1. Trivelli, A. P. H., and Loveland, R. P., Photomicrography of Silver Halide Grains with Ultraviolet Light, J. Opt. Soc. Am. 20:97 (1930).
2. Spinell, B. M., and Loveland, R. P., Optics of the Object Space in Microscopy, J. Roy. Microscop. Soc. 79:59 (1960).

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The Need for a Medical Communication Expert in a Medical Center*

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IT has been my experience that almost any member of a medical school faculty or hospital staff will, if asked, express an "expert" opinion on how teaching should be done, or on how to communicate properly with those who are being taught, which means perhaps that medical centers are already filled with medical communication experts. This paper, however, deals with the need for a medical communication expert who has had special training and background in the field of communication and its various disciplines with special application to the field of medicine.

Perhaps I should start with a definition of the key words in the title of the paper as is often done, but I am sure that the words "communication" and "expert" convey meanings to each of you which are sufficiently definite and not too far divergent to serve as a common ground beginning for the thoughts to follow. It is hoped that the detailing of the functions of a medical communication expert in a medical center will picture him for you more completely and more clearly than any definition could, and will demonstrate to you the need for such an individual in a medical center when you realize, as you will when you think about it, how few of these functions are being completely or even adequately carried out at the present time.

Many of the functions which could be served by a communication expert in a medical center are suggested in the following paragraphs.

Coordination of Communication Activities

The communications expert should act as the director, administrator or coordinator under whose supervision would come the individuals or departments which are skilled in the preparation of communication or audio-visual materials and are skilled in the handling of the communication or audio-visual devices or "machines by which the materials are exhibited or presented" (Definition of audio-visual devices from Holland, Hartsell and Davidson[1]). This group of skilled individuals would be, of course, the photographer (still and motion picture), the artist or medical illustrator, the television specialists, the audio specialists (radio, recorders, public address systems), the equipment service specialists, the duplicating techniques specialists and others.

*Presented at the 31st Annual meeting, Aug. 21, 1961, at Chicago, Ill.

Activities Related to Teaching

The majority of medical teachers have not had any special training in the educational disciplines in preparation for their teaching assignments. Together with this, the scientific and technological advances in recent years have so increased the number of communication materials, devices and techniques that it is not practical for the medical teacher, with his many other duties, to attempt to search out for himself first hand information concerning these advances and the ways in which they can be used to improve his communication with the student. No single medium or device, and there are many of both*, each with its champions, can be used for the most effective portrayal of all areas of even a single presentation. The communication expert would be prepared to give worthwhile advice on which medium or technique could best put across any particular part of a presentation and he could expedite its use by calling on the appropriate specialist or specialists under his direction for help. This selection of the most effective way of presentation is extremely significant. Lewis, Brown and Harcleroad[2] point out that "optimum learning occurs when all types of materials are used, each for its own special contribution". Also the concept of correct "programming" of instruction is becoming increasingly important and the communication expert should have background which will enable him to be helpful in this area. Still another aspect of communication which needs the assistance of the expert is the design and carrying out of research on the effectiveness of the teaching presentations as planned and on the ways of improving the effectiveness. An additional service in connection with teaching is the establishment and maintenance of a library of communication materials and the knowledge of and evaluation of materials (films, film strips, slides, models, recordings, etc.) which are available from extramural sources.

Activities Related to Medical Research

The obvious way in which the communications expert can be of help to the researcher is in the reporting of the results of the research and the delineation of its significance by the various means which can be used for the dissemination of new information of this type—articles in Journals, motion picture films, papers presented at scientific meetings, exhibits, teaching models (if appropriate), etc. Another very important, though less obvious, type of service is the making available to those doing research of such observation and visual recording equipment (still or motion pictures, television in various forms of sensitivity combined with video-tape recording, for example) as might be indicated and, perhaps, audio recording equipment, also.

*To emphasize the number of media and devices which now must be kept in mind, the following listing is presented but no assumption is made that this is a complete enumeration: chalk boards, display boards (flannel boards, magnetic boards, bulletin boards) flip charts, wall charts, graphics and a multitude of other types of art work, models, dioramas, exhibits, microprojectors, slides (2 x 2 and standard size), stereo pictures (with their viewers and projectors), filmstrips, slide and filmstrip projectors combined with recorded description, opaque projectors, overhead projectors with large transparencies (rapidly produced by many methods—diazo processes, lifting colored pictures from a printed page, very rapid heat-light transfer processes) and many other projecturals (overlays, ones animated by the use of polarized light, working models of transparent plastic, rolls of plastic film for "black board" use), motion picture films (16 mm and 8 mm sound with all of its exciting possibilities), stereophonic and monaural tape and disc recorders, public address systems with wireless microphones (giving the speaker complete freedom to move anywhere in the room), radio, television (both closed and open circuit and "scrambled image") with video-tape recorders and kinescopes, teaching machines and/or self instructional devices, improved duplicating processes of many kinds (which simplify the preparation of hand-out material).

Activities in Connection with Public Relations

The structuring, design and execution of informational materials (booklets, charts, motion pictures, photographs, posters, exhibits, etc.) could be greatly benefited by the services of the communication expert and the specialists whose skills he coordinates.

Services to the Administrative Officers of the Center

The communications expert could be definitely helpful in the preparation of reports, statistical summaries, substantiation of budget and support requests, and appeals for funds. Other areas of service in this category would undoubtedly be found were such a person available.

Activities Related to the Planning of Teaching and Display Areas

A great deal depends on the proper planning of teaching and display areas so that effective use can be made of the many communication materials and devices.

In addition to the above functions which could be carried out by the communication expert himself, the number of services which are being or could be furnished by the specialists who would make up his department are legion and many of them are obvious to you. For example, you are familiar with the multitude of services which the medical photographer may be called upon to perform—photographs (still or in motion) of patients and their lesions, specimens, microscopic slides, as well as, operations and special treatments, buildings, rooms, equipment and instruments, textbook illustrations and art work, and perhaps hospital personnel and students.

You may well say that the "medical communication expert" whom I have been describing for you is the "A-V administrator" who has been described on numerous occasions, or you may want to give him one of many other names that have been given to a person who might serve most of the functions outlined above. For example, the Director of "A visual education department in the medical school" discussed in the excellent two-part article on this subject by Thomas S. Jones and J. Edwin Foster[8] fits the picture quite well. Some of the other names which have been used are: A-V communication specialist, A-V coordinator, A-V specialist, educational media specialist, teaching-learning materials specialist and bio-medical communication specialist. Dr. Richard H. Orr, Director of the Institute for Advancement of Medical Communication, has made a plea (personal communication) for the "generalist" in Bio-Medical Communication. "The equivalent of a family physician—a generalist—who knows enough about the various techniques and media to be able to use intelligently the services of the specialist" and he must have "scientific subject-matter competence".

One could well say "What's in a name?" and I would agree that I know of no name for this paragon of virtues with which one could not take issue. The connotation of the word "communication" does, however, appear to give greater breadth and greater depth to the concept of the individual being discussed than does the designation "audio-visual", because, perhaps, audio-visual seems to be, at least by many people, associated with the tools of instruction and the materials displayed by them. This concept of audio-visual is in the process of being broadened.

Many are the attributes which our "medical communication expert" should

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The structuring, design and execution of informational materials (booklets, charts, motion pictures, photographs, posters, exhibits, etc.) could be greatly benefited by the services of the communication expert and the specialists whose skills he coordinates.

Services to the Administrative Officers of the Center

The communications expert could be definitely helpful in the preparation of reports, statistical summaries, substantiation of budget and support requests, and appeals for funds. Other areas of service in this category would undoubtedly be found were such a person available.

Activities Related to the Planning of Teaching and Display Areas

A great deal depends on the proper planning of teaching and display areas so that effective use can be made of the many communication materials and devices.

In addition to the above functions which could be carried out by the communication expert himself, the number of services which are being or could be furnished by the specialists who would make up his department are legion and many of them are obvious to you. For example, you are familiar with the multitude of services which the medical photographer may be called upon to perform: photographs (still or in motion) of patients and their lesions, specimens, microscopic slides, as well as operations and special treatments, buildings, rooms, equipment and instruments, textbook illustrations and art work, and perhaps hospital personnel and students.

You may well say that the "medical communication expert" whom I have been describing for you is the "A-V administrator" who has been described on numerous occasions, or you may want to give him one of many other names that have been given to a person who might serve most of the functions outlined above. For example, the Director of "A visual education department in the medical school" discussed in the excellent two-part article on this subject by Thomas S. Jones and J. Edwin Foster[8] fits the picture quite well. Some of the other names which have been used are: A-V communication specialist, A-V coordinator, A-V specialist, educational media specialist, teaching-learning materials specialist and bio-medical communication specialist. Dr. Richard H. Orr, Director of the Institute for Advancement of Medical Communication, has made a plea (personal communication) for the "generalist" in Bio-Medical Communication — "The equivalent of a family physician — a generalist — who knows enough about the various techniques and media to be able to use intelligently the services of the specialist" and he must have "scientific subject-matter competence".

One could well say "What's in a name?" and I would agree that I know of no name for this paragon of virtues with which one could not take issue. The connotation of the word "communication" does, however, appear to give greater breadth and greater depth to the concept of the individual being discussed than does the designation "audio-visual", because, perhaps, audio-visual seems to be, at least by many people, associated with the tools of instruction and the materials displayed by them. This concept of audio-visual is in the process of being broadened.

Many are the attributes which our "medical communication expert" should

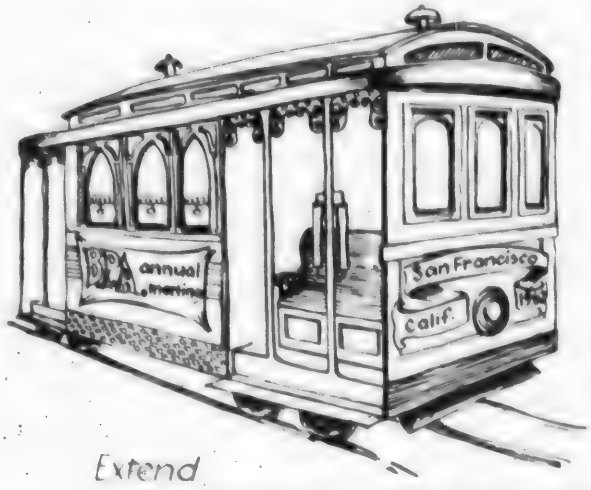
have and these would include administrative ability and the ability to tactfully guide the professional people whom he will be called upon to assist in their communication problems. The qualifications, necessary background and training of the individual we are discussing are all intriguing but they are the province of Mr. Seymour Friedberg. (Mr. Friedberg was the speaker who followed me on the program.)

Although the material presented in this paper is specifically related to a medical center, it could well apply with, perhaps, some modifications to other similar or even somewhat dissimilar organizations.

In closing, I would suggest that if you should be desirous of doing some serious reading directly related to this whole subject the proceedings of a DAVI Seminar on "The Education of the AV Communication Specialist" edited by Fred F. Harcleroad[4] will provide you with an excellent opportunity to do so and will also furnish you with a most worthwhile bibliography.

REFERENCES

1. Holland, B. F., Hartsell, H. C. and Davidson, D. L. AUDIO VISUAL MATERIALS. Rogers Litho, 1958.
2. Brown, J. W., Lewis, R. B. and Harcleroad, F. F. A-V INSTRUCTION — MATERIALS AND METHODS. McGraw-Hill, 1959.
3. Jones, T. S. and Foster, J. E. A VISUAL EDUCATION DEPARTMENT IN THE MEDICAL SCHOOL. Journ. Med. Ed. 30:1, Jan. 1955, p. 57-59 (second part in February, 1955, 30:2, p. 120-126).
4. Harcleroad, F. F. THE EDUCATION OF THE AV COMMUNICATION SPECIALIST. AV Communication Review 8:5 Supplement 2 Sept.-Oct. 1960.



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Journal of the Biological Photographic Association · Vol. 29, No. 4 · November, 1961

A Double Boom Mount for Photomicrography*

KENNETH A. ARENDT, Ph.D.** and B. WAYNE BEATON

MOST researchers involved in photomicrography have occasion to use two or more types of film for recording a given subject. This frequently involves a somewhat cumbersome demounting and remounting sequence which may be too time consuming as well as annoying when the object to be photographed is particularly labile.

A biological laboratory ordinarily includes two or more boom mounted dissection microscopes which, when very simply modified, can obviate the need for rather costly camera mounting equipment.

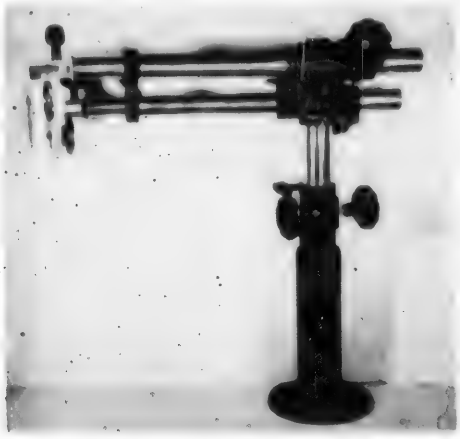

Figure 1. Stack-mounted booms on standard vertical column (American Optical Co. dissection microscope).

In our laboratory we are currently involved in a study of the living microscopic blood vasculature of compact bone. Still photomicrographs are useful for determining vascular patterns and vasomotor changes, but they are of relatively little value in monitoring subtle variations in blood flow. These latter phenomena must be recorded with motion pictures.

To facilitate rapid, smooth switching of cameras, two booms (American Optical Company) were stacked on one upright pillar. Because of the nature of our animal preparation it was necessary to elevate the entire assembly. This was accomplished by removing the commercially-made base and mounting the

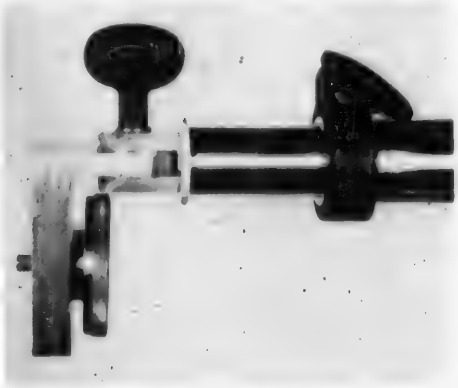

Figure 2. Camera mount adapter.

* Aided by grant A-1762 from the National Advisory Council on Arthritis and Metabolic Diseases of the National Institutes of Health.

** Department of Physiology, School of Medicine, Loma Linda University, Loma Linda, California.

The authors are indebted to Mr. Earle C. Beeman for excellent craftsmanship in adapting equipment to specifications.

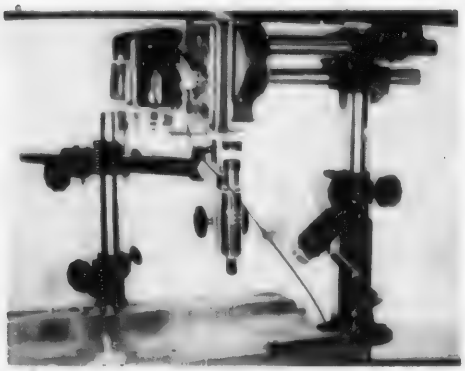

Figure 3. Motion picture camera in position above microscope draw tube.

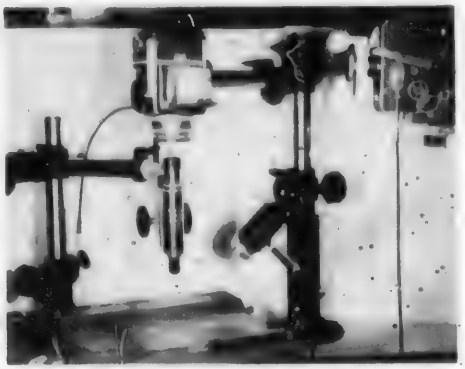

Figure 4. Booms rotated to bring still camera into position.

pillar on a pedestal consisting of an 8" section of $1\frac{7}{8}$" (I.D.) pipe and a standard $5\frac{1}{2}$" flange which is fastened to the laboratory deck (Figure 1). If desired, the factory assembled base may be left intact and placed upon a box or other raised platform. In the event that the booms are needed to support microscope heads, they are readily demountable.

The camera mount is constructed from aluminum stock and simply occupies the position of the microscope head mounting flange (Figure 2).

Figure 3 shows the Bolex H 16 in position for motion picture recording. A simple rotation of one boom brings the still camera into position above the microscope ocular (Figure 4). Cameras may be used with or without their taking lenses.

The dissection microscope mount offers the additional advantages of considerable flexibility in vertical, horizontal, and rotational adjustments.

PHOTOGRAPHER

There is an opportunity for an intelligent person wanting to grow in his profession. The hospital needs a man with a thorough knowledge of photo techniques, processes and equipment work in color and black and white for records, research, study, teaching and publications. Gross and microscopic specimens and broad P.R. type work. Process films of all kinds, make prints and transparencies, including lantern slides. Hospital experience helpful, but 3 to 6 years of photo work will be accepted. Work with all new modern equipment in an expanding organization. Attractive salary, life insurance, pension plan, sick leave and many other benefits. Submit resume in first letter, giving full details and salary requirement to the Personnel Department.

ST. LUKE'S HOSPITAL
2900 West Oklahoma Ave. Milwaukee 19, Wisconsin

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The Master Key

RICHARD C. MATTHIAS

Medical Illustration Unit
Smith Kline & French Laboratories, Philadelphia, Pa.

FORTY years ago, medical photography was recognized as a profession which was limited to showing disease states with slides and prints of specimens, patients and X-rays. Today, medical photography is a complex profession. The photographer has become a visual communications director-coordinator who develops most of the visual elements required for successful medical education. Visual communications is his business. He is the backbone of the educator. His basic tools are his cameras and lights; his resources are the devices and materials used to create the visual components of communication. In order to reap the full benefits of these tools and resources, he understands the many forms these instruments of communication take and the functions of each. Equally important, he continually searches for new and better methods of producing visuals, particularly methods which will save time and money.

Many visual communication techniques are used to "get the point across"; motion pictures, filmstrips, slides, televisuals and overhead projectuals are the most common. Their production is usually a two-step process of preparing artwork and then photographing it. Because there are special requirements regarding size and photographic characteristics for both steps, an integrated system which would enable the user to render artwork and photograph it with minimum variability while maintaining flexibility would be ideal.

I have designed a visual aid production system, based on the Tecnifax Slidemaster System, which synchronizes all phases of production from the drawing board to the finished product. The Master Key of the system is a pin-registration bar. This bar provides uniform, mechanical registration between the drawing board and copy stand.

The pin-bar used in this system has three machined pins positioned on a bar with the end pins equidistantly spaced 7/8" from the center pin. All original material is hand-perforated on a Tecnipunch with a 3/16" round center hole and 3/16" x 1/4" elongated end holes. The elongated shape of these end holes permit distortions to be distributed toward the less critical edges of the artwork.

Registration must begin at the drawing board, since this is the first phase of visual aid production. A practical and versatile unit especially designed for this system is an illuminated drawing board with a recessed pin-registration bar. (Figure 1) A standard 21" x 26" Mayline drawing board with a built-in parallel rule was converted so that it could be illuminated from below. This was done by centering a 10" x 12" opening for a three-lamp fluorescent light box. The surface of the board is covered with 1/8" opal Plexiglass milled to accept a pin-

registration bar and two rulers. The aluminum angle above the pin bar serves as a tool tray. Four switches at the top of the board include a line switch on the left and three fluorescent starting switches on the right. It is an ideal drawing board for preparing opaque and translucent illustrations and can also be used for tracing, viewing transparencies and opaquing or stripping negatives. Whenever cutting is necessary, a sheet of Mylar will protect the Plexiglass top.

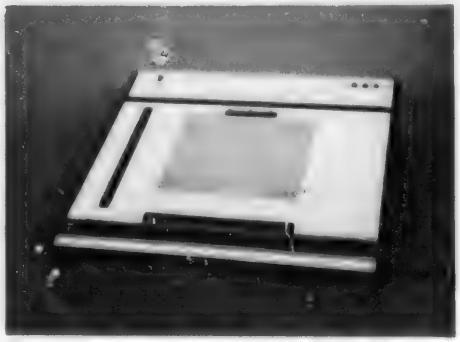

Figure 1.

Because standardization is an important consideration for a completely functional system, all artwork is prepared on punched, 11" x 14" stock. Transparent Plexiglass templates of the same size are used to delineate the proper proportions of the work so these will correspond with the proportions of the photographic technique to be employed. These templates are keyed to the pin-bar and pre-determine the framing area with a marginal set of holes and the information area with the innermost set. Illustrations can then be rendered using any of the standard methods.

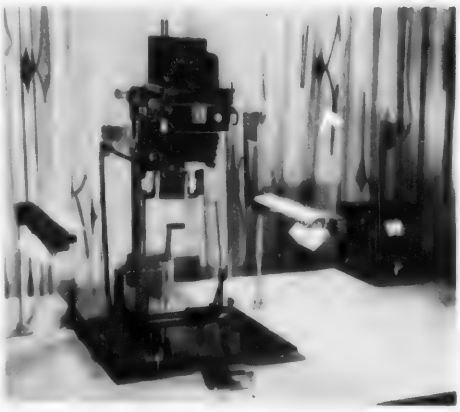

Figure 2.

Photographic reproduction of completed drawings is done on the system's single copy stand. It is a stand designed to provide the photographer with a single instrument for doing trans-illuminated or reflected-light copy work with any camera and without incandescent illumination. (Figure 2) The basic stand consists of a camera support adapted from a Chicago-Majestic Tripod mounted on a one-inch plywood table. (Figure 3) The camera carriage, attached to the geared center column, is a universal tilting gear head suspended from an adjustable arm bracket. Since this is an adjustable arm, either a 3¼" x 4¼" view camera, a 35 mm. reflex camera or a 16 mm. motion picture camera can be centered above the copy area.

Figure 3.

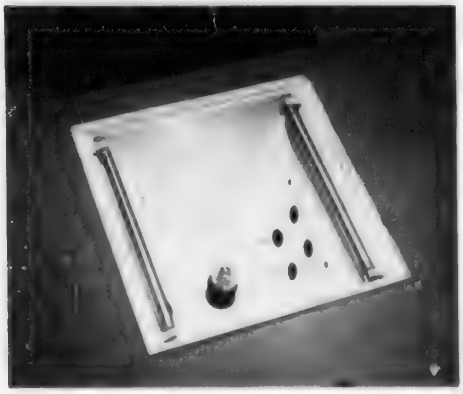

Figure 4.

Figure 5.

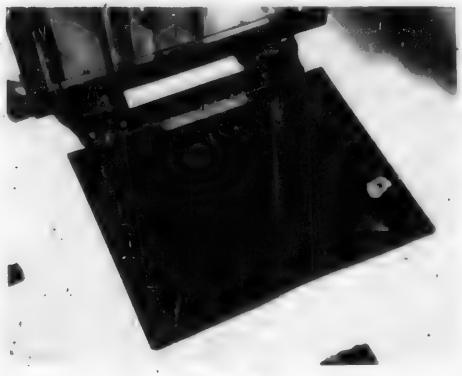

Figure 6.

Transillumination for reproducing transparencies and overhead projectuals, is done on a Kodak Transparency Illuminator modified to accept two light sources and recessed in the center of the copy area. (Figure 4) The focusing light source is a pair of six-watt fluorescent lamps operated from a single push-button switch. Since each lamp is positioned on a lateral wall near the surface of the viewbox, they were partially aluminized to distribute light evenly. The photographic light source is an FT-120 electronic flashtube mounted in a four-pin radio socket which replaces the illuminator's original incandescent lamp. This strobe assembly and its AC power supply were adapted from a Hershey Model 110 Sun Lite Flashgun. A single toggle switch activates the power supply and, at the same time, connects the stand's single camera shutter cord to the flashtube.

The surface of the illuminator is opal Plexiglass with a recessed pin-registration bar positioned to center pre-punched overhead projectuals on the light source. (Figure 5) When the illuminator is used for reducing 8" x 10" transparencies it is done by first placing them in a pre-punched Diazochrome Slide Mount. This mount functions as a holding and alignment device.

Slides can be duplicated using slide holding masks keyed to the pin-registration bar. The 35 mm. mask has a 1¾" square opening; the 3¼" x 4" mask a 3" x 3¾" opening. Both openings center on the light source. A slide-retaining frame prevents shifting and assures accurate positioning.

Covering the illuminator with an 11" x 14" Bakelite support transforms the illuminator into a reflected-light copy area for opaque artwork. (Figure 6) This support is keyed to the illuminator's

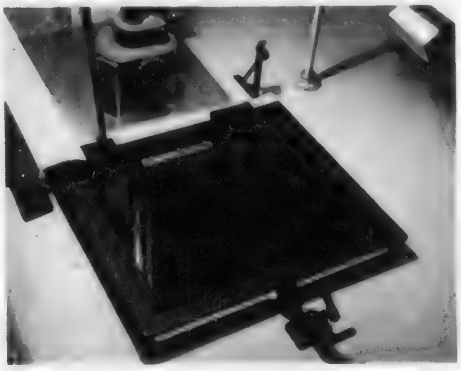

Figure 7.

Figure 8.

pin-bar to center it within the copy area. In addition, it has a recessed pin-registration bar corresponding to the punching position on the standard 11" x 14" stock used for artwork. Therefore, this support can be used to copy all opaque work, but it must be covered with a pre-punched white card for translucent material.

To compensate for uneven artwork, particularly multi-cell animation, a springloaded floating-glass platen from a Fra-Mar Copy Board was positioned to close over the central portion of the copy area. (Figure 7) The adjustable tension clamp and platen frame stops were restored to their original locations.

The stand's two top light units incorporate the same general principle as that used in the illuminator—fluorescent for focusing and strobe for photography. (Figure 8) Each unit consists of a Mecablitz 106 flash head suspended from an eight-watt fluorescent fixture supported by a universal arm which also conceals the wiring. Since a stock Mecablitz 106 operates on nickel-cadmium batteries, the AC power pack was designed to replace them. Two switches control both light units simultaneously; one operates the fluorescent lamps, the other activates the AC power supply and connects the shutter cord to both flash heads.

I realize that this system, with its drawing board and copy stand, are not the ultimate — nor is the system really complete. But it is a beginning toward a completely integrated system, which possesses a great deal of potential. The same Master Key can be adapted to darkroom procedures and Hot Press titling and pave the way for short-cutting a lot of other visual communication techniques.

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Relief Line Process for Lantern Slides

ARTHUR SMIALOWSKI
St. Michael's Hospital, Toronto, Canada

THE relief line process is a relatively simple method by which an unusual effect can be achieved to show the lines and printed text in a manner which gives it a plastic appearance.

This method may be successfully employed when a photographer wishes to make a lantern slide which will be out of the ordinary and sometimes startling. In common with all other unusual processes, the method has to suit the subject and the occasion for which it is intended. Since this procedure employs solarization, it is rather difficult to have exact control over a number of slides that will have uniform appearance. Therefore, it is advisable to use this method when a limited number of slides are to be made.

The relief line process offers a number of variations in presenting the image. Various exposure and developing times will influence the densities and contrasts, which may be selected for different subjects. Although this method can be utilized for half-tone photographic illustrations, the best results are usually obtained when it is used for lantern slides.

Steps for Relief Line Process

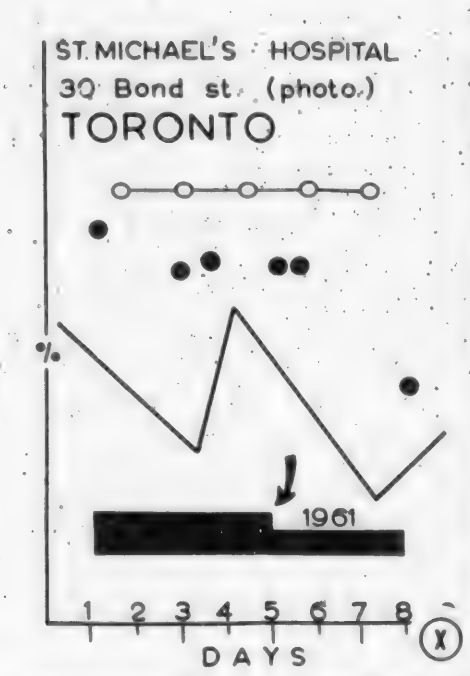
Photograph the original line drawing or printed material using high contrast film, the same as is used in making negatives for lantern slides. The negative, after it has been normally processed and dried, is put in the enlarger and printed onto a lantern slide contrast plate in the usual way. Develop the positive slide fully which usually takes several minutes. Ordinarily the lantern slide is usually then fixed, but for the relief line process method the slide is removed briefly from the developer and exposed (fogged) to a white light for about one or two seconds. This exposure is done with white light which reads .8 on a Weston meter with the photoelectric cell facing the light source at eight feet.

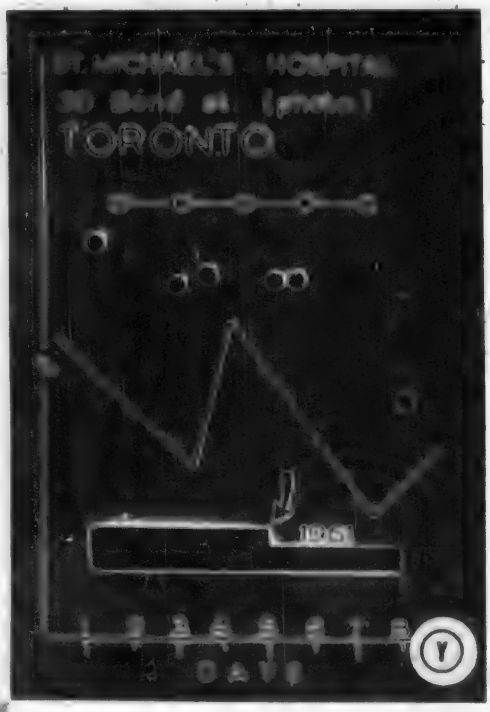
After the fogging operation, place the lantern slide back into the developer and resume developing with constant agitation for about ten to fifteen seconds. The lantern slide will then have an overall dark appearance. It is then removed from the developer, fixed, washed and dried. The slide will now appear as is shown in Fig. 1(Y).

When the lantern slide is dry, put it back into the enlarger and print it on a high contrast or medium contrast lantern slide plate. The variations of the length of the exposure will give a background which may range from light grey to black. The choice will depend upon the effect wanted and can look similarly as shown in Fig. 1(Z) or Fig. 2.

All these steps are carried out under suitable safety light conditions for lantern slides, except during the duration of fogging, washing and drying.

The inquisitive worker will find that by making changes in the fogging time and intensity and by variations in developing, it will be possible to alter the general appearance of the lantern slide.





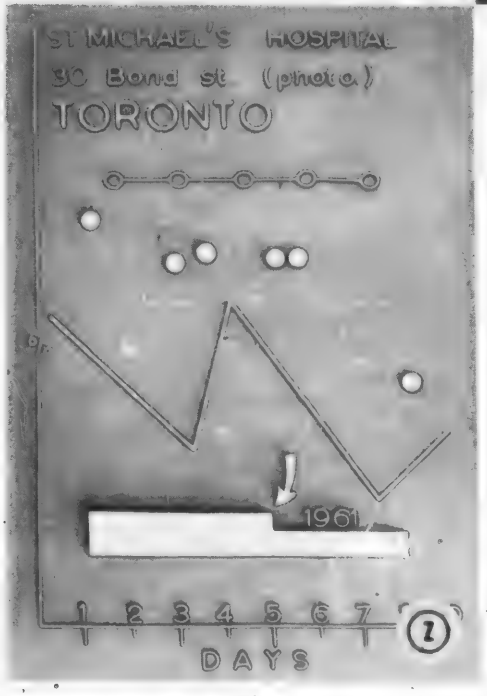


Figure 1. Steps for making relief line process lantern slides. X, appearance of fully developed lantern slide under safety light. Y, after it has been exposed to white light, re-developed, fixed and dried. Z, lantern slide made from Y, which was exposed to show medium grey background.

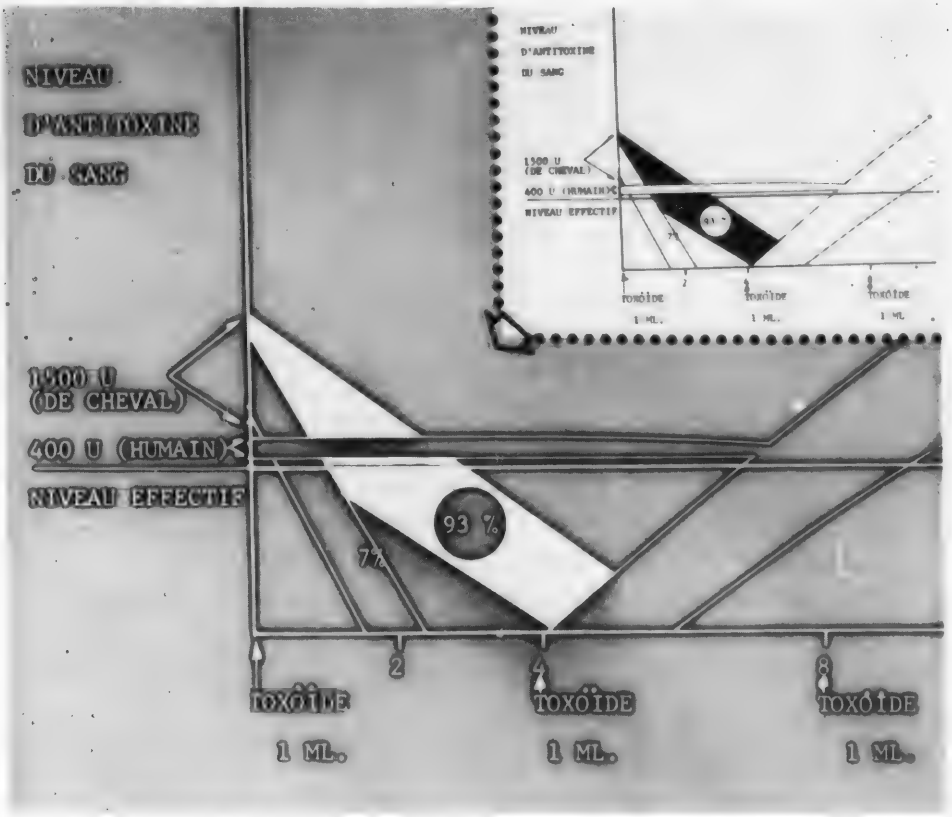


Figure 2. A relief line process print made from the original drawing and typewritten copy. The original is inserted in the right upper corner. The relief line process is well suited for making lantern slides measuring $3\frac{1}{4}$ x 4 inches and 2 x 2 inches. Slides made by this method have an unusual plastic appearance.

The relief line process is a simple method for giving lantern slides new dimensions.

REFERENCES

Danziger, David: Legibility of Lantern Slides. J. Biol. Photographic A. 24:4-6, 1951.

Tribe, Howard E: A Method for Making Quality Line Lantern Slides Economically. J. Biol. Photographic A. 24:72-75, 1956

Maurer, John A: Practical Lantern Slide Projection. J. Biol. Photographic A. 10:123-129, 1942.

Smialowski, Arthur and Vailé, Sigmund: Composite Mounting of Thirty-Five Millimeter Color Transparencies. A.M.A. Arch. Optho., 60:321-323, 1958.

The Focal Encyclopedia of Photography. London, Focal Press, 1957. P. 1079, Solarization.

MEDICAL AND BIOLOGICAL ILLUSTRATION

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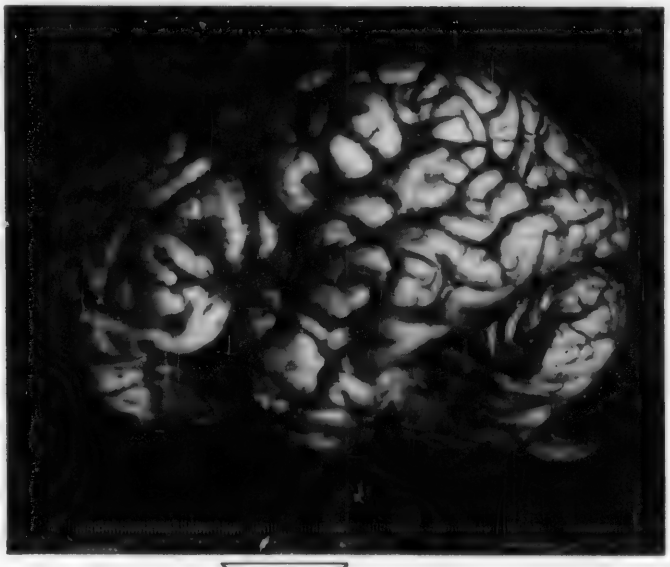

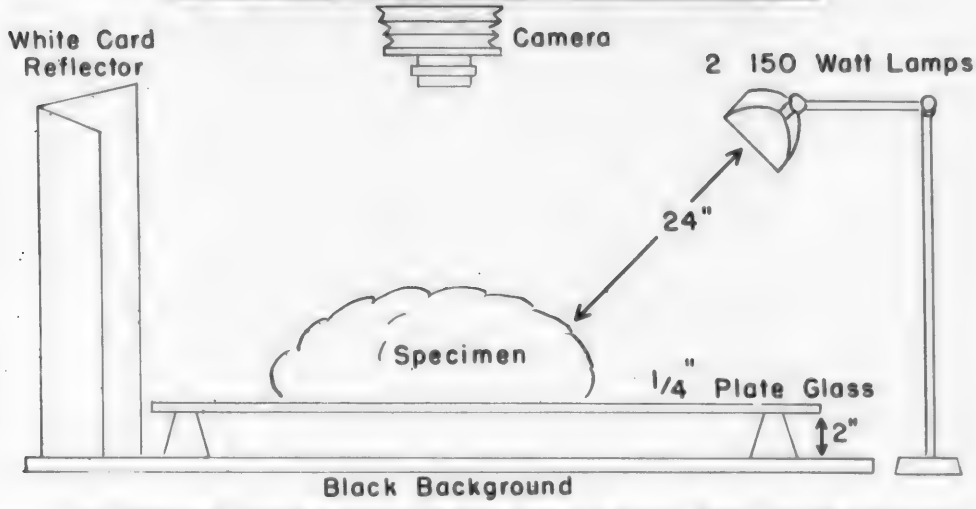

The specimen is placed on a sheet of plate glass, two inches above a black background. Two 150 watt lamps, in a reflector, are positioned above and about 24 inches from the subject, a white card reflector is used on the opposite side to "fill in" the shadows.

Film: E.K. Royal Ortho — Exposure 3 seconds at F. 32 — Developed in D.K. 50.

A SUGGESTION

To reactivate Dr. Fallon's idea of an Encyclopedia of Bio-Photography I should like to propose that a series of "Data Sheets" similar to the one above, be published in each issue of the journal.

Each member could furnish several sheets covering the work he performs most often and which he believes to be the most efficient method for obtaining optimum results.

L. B. Brown

BPA Louis Schmidt Award Citation Chicago, 1961

This pleasant interlude gives me the privilege to act for the entire membership in presenting the Louis Schmidt Award to one of our outstanding Fellows. As you know, in order to gain this recognition in the biomedical photographic field, the recipient must have rung the bell. This can never be said so truly as it can be tonight.

All of us here have arrived at our successes through varied routes. But our candidate has a rather distinctive talent to serve as a background for his love of proficiency. In spite of an American Groton-Harvard schooling, he is a member of the exclusive British: Ancient

Society of College Youths. But he had to pull strings to get in. For you see, this Society is devoted to the difficult art of pealing bells hung for change-ringing. To qualify, he had to ring a peal requiring 3 hours of musical and athletic skill.

There is only one group with more rigorous qualifications, and that is the Modern Society of Louis Schmidt Award Holders. But here you do not need to pull strings, because no candidate even knows that he is being considered. Instead you have to pull instructional photographs out of the still air of intangible ideas. For example, the plan for a teaching film is very much like a tower hung with bells. The potentialities for numerous changes exist in advance, but the creative photographer is the one who rings the peal. The techniques themselves are as silent as bells until they are rung.

The present recipient is not only eminent in that which he has done *with* photography but also in that which he has done *for* photography. He is an active member — spelled with capital and small "A" — in associations like the: American Writers Association, Pharmaceutical Advertising Club, Screen Directors International Guild, and Society of Motion Picture and Television Engineers. Thus like most of our members, he extends his interest to communication through motion pictures. In fact, he has been the General Chairman of the American Film Assembly and held offices in the New York Film Council, including its presidency. He has also presented papers on medical photography to his associates.

For our own Association he has been energetic in its affairs and on the Board of Governors for about 10 years. It is safe to say that during some of our difficult periods, the BPA would have felt drastic set-backs had it not been for his fine cooperation. These activities, extensive help at our headquarters, and the use of his studio for Board meetings, have been warm expressions of loyalty to the BPA on the part of Past President Warren Sturgis, FBPA.

H. Lou Gibson

NEW MEMBERS THROUGH OCTOBER 31, 1961

CALIFORNIA: *Alameda*, Miss Betty J. Lofstrand, 752 Pacific Ave. *Los Angeles*, Magemi Giora, 504½ N. Sweetzer Ave. *San Francisco*, Melvin J. Kranke, 1955 42nd Ave. *San Francisco*, Miss Hedy Krasnobrod, 678 Third Ave.

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OHIO: *Cleveland*, Charles P. Astorino, 14896 S. Gallatin Blvd.

PENNSYLVANIA: *Philadelphia*, John Webb, Webb & Company, 3415 Walnut St.

TENNESSEE: *Nashville*, Mayhew F. Koellein, 3801 Haywood Court.

WISCONSIN: *Milwaukee*, Charles A. Harris, St. Luke's Hospital.

CANADA: *Halifax*, N.S., Leo Diamond, Dept. of Medical Photography, Dalhousie University, Victoria General Hospital. *Saskatoon*, Sask., Miss Mary Farley, Medical Photography Lab, University of Saskatchewan.

MEXICO: *Mexico, D.F. 7*, Eucario Lopez Ochoterena, Biologo, Sinaloa No. 75-4.

Association News

A section of the Journal devoted to official announcements, chapter events, and other matters of historical significance to the Association.

At the first business meeting of the B.P.A. in Chicago, Illinois, August 21, 1961, the President's report covered areas of Journal editorship, increased membership services and plans for proceeding with the Standards and Certification program. He acknowledged the efforts of Mr. Massopust and Mr. LaRue during the past two years and announced the acceptance by Mr. Massopust of the Board invitation to continue as Editor. The assembly joined the President in his expression to Mr. Massopust by according him a rising vote of thanks.

The major part of the meeting was devoted to a discussion of the Board's recommendation for a raise in annual dues. It was moved, seconded and carried, that the dues be raised by the recommended $3.50.

It was agreed to amend the constitution to prescribe a minimum for Contributing Members and to allow the Board to set that minimum. The proposed amendments will be sent to each member and a vote by mail will be taken.

The 1962 Annual Meeting will be held in San Francisco at the Jack Tar Hotel, beginning on Aug 20. Tom Masterson is the general chairman.

The meeting dates for the 1963 Annual Meeting at Atlanta, Georgia, are August 12-15. The Dinkler-Plaza Hotel will host the meeting. Mr. J. Robert Dant is the general chairman.

The headquarters office of the National Society for Medical Research has been moved from Chicago, Illinois to Rochester, Minnesota on October 16, 1961.

The Society's headquarters have been in Chicago for 15½ years.

The move was made to take fullest possible advantage of the leadership of the Society's new President, Dr. Hiram E. Essex of the Mayo Foundation for Medical Education and Research. The move also is expected to reduce some operating costs while bringing better operating facilities.

The new address of the Society in Rochester will be 111 Fourth Street, S.E.

New Products

ANSCOCHROME TYPE DUPLICATING FILM NOW AVAILABLE

Anscochrome Duplicating Film Type 544, a 35mm reversal color film designed for duplicating positive color transparencies and positive film strip originals, has been announced by Ansco, Binghamton, New York, the photographic manufacturing division of General Aniline & Film Corporation.

Anscochrome Type 544 is excellent for making "blow ups" from 16mm originals and may also be used for making prints directly from 35mm motion picture projection prints. It is compatible with Anscochrome film and may be processed in Anscochrome chemicals.

Availability	List
100 ft. DXL (Darkroom loading)	$5.55
100 ft. DLL (Daylight loading)	14.65
20 ft. (Color Identity)	.75

NEW COMPACT ROLLEI PROJECTOR ADAPTER

To provide owners of Rollei cameras having detachable hoods with a compact, convenient and low-cost means of projecting their 2¼x2¼" color transparencies, Rollei has just introduced the new Rollei projector adapter which projects through the camera viewing lens, with the usual camera focusing operation.

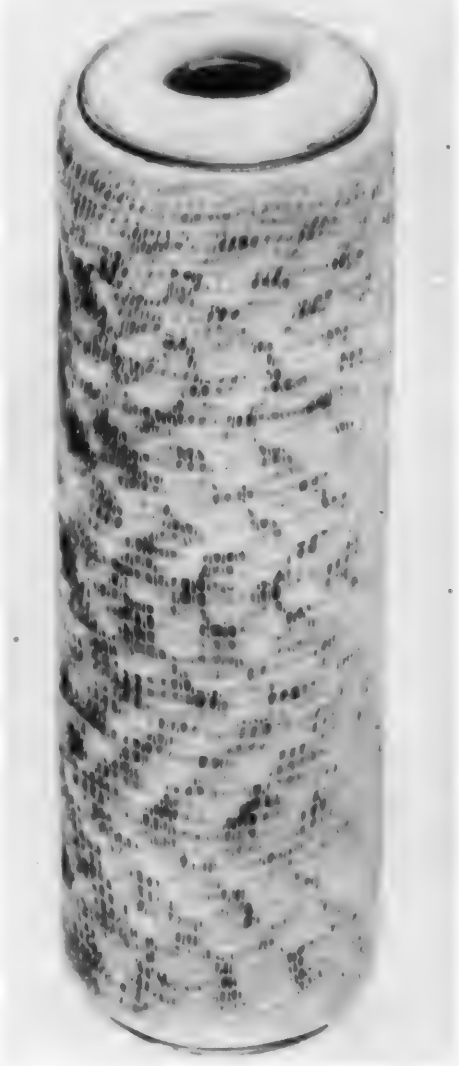
Entirely self-contained and employing a six volt 35-watt auto bulb, the unit measures only 9"x6¾"x4". To operate, the focusing hood is removed and the inverted camera inserted into the camera frame on top of the projector. It projects 2¼ slides up to 18" square and using Rollinar lenses up to 30" square. For table top projection, a table top screen (18"x18") is available.

The projector adapter is supplied with a double 2¼x2¼ slide carrier, A.C. cable and lamp. List price, $49.50. Slide carriers for 2"x2" slides also available at $2.50 each. Table top screen, $10.00.

NEW AFCO FEUTRON FILTER CARTRIDGE AVAILABLE FOR PHOTO LABS

American Felt Company, Glenville, Conn., has announced that its new AFCO Feutron Filter Cartridge is now being used with excellent results as a filtration medium by several major photo-processing labs to clarify developing solutions.

The new filter cartridge, made of custom-manufactured synthetic fiber felts of controlled denier, can be tailor-made to meet nearly any liquid filtration requirement. Because of the precise control of its manufacture, the AFCO



Fentron Filter Cartridge can be supplied to exclude undesirable particles.

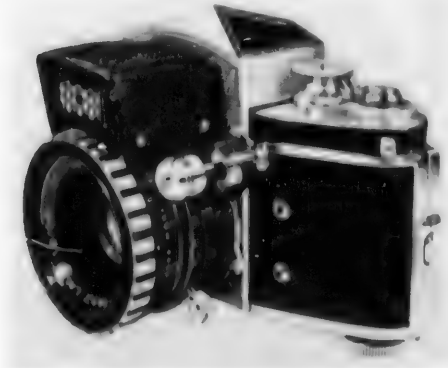
AFCO Fentron Filter Cartridges are made from chemically pure synthetic fiber felts and a core of stainless steel. The fibers are of uniform denier and are felted into a filter body of uniform density and texture.

The AFCO Fentron cartridge which fits most standard canisters uses the "edge wise" principle of filtration and it can be installed in the production line with minimum restriction of flow rate.

Photo processors who have used the new AFCO Fentron Filter Cartridges in their production lines report that in addition to cleaning developer of emulsion particles and undissolved impurities in the solution itself, pump life has been lengthened and the need for replacing cartridges has been greatly reduced.

In some industries where liquid filtration problems impose an exceptionally heavy demand on cartridges, users report AFCO Fentron cartridge life has been increased up to six times that of conventional cartridges.

Information about the AFCO Fentron Filter Cartridges may be had by writing American Felt Company, 2 Glenville Road, Glenville, Conn.



ISCO INTRODUCES NEW ELECTRIC EYE ISCO-MAT LM F1.9, 50MM AUTOMATIC LENS FOR EXAKTA!

Isco Optical Works, Gottingen, Germany, is now introducing to the American market the new F1.9, Isco-Mat LM 50mm lens . . . the first of a new series of Electric-Eye Isco-Mat lenses for the Exakta. This new lens is truly spectacular, for it offers the advantages of an Electric Eye photo-electric exposure meter lens, and yet the meter can be detached in seconds so that the lens may function as a conventional lens.

The New Isco-Mat LM Electric-Eye lens has a built-in instant-reopen automatic diaphragm that is cross-coupled to the "detachable" photo-electric meter which fits on the top of the lens. When the Isco-Mat LM lens with meter attached is pointed at the subject to be photographed, a needle in the meter moves to a marker. The camera owner then lines up the second needle over the first, and by doing this automatically sets the diaphragm opening for the correct exposure. There are no calculations, no intricate settings, no time wasted. There is also a visible depth of field scale band that changes as the diaphragm ring is changed from one aperture to another. Only the area that will be needle-sharp, becomes visibly apparent to the Exakta owner at a glance.

The Isco-Mat LM F1.9, 50mm lens is a 6-element objective. It has 8 diaphragm stops, F1.9, 2.8, 4.0, 5.6, 8, 11, 16 and 22. The lens focuses from infinity down to 20 inches; and renders a 45° angle of view. Beautifully finished in black with chrome trim, the Isco-Mat LM, 50 mm, F1.9 lens with automatic diaphragm complete with photo Electric Exposure Meter is priced at $150. For colorful brochure, write to Exakta Camera Company, 705 Bronx River Road, Bronxville, New York

ANSCO MEMO MASTER 8MM PROJECTOR FEATURES ZOOM LENS

A new 8mm motion picture projector, which permits a 200% increase in picture size without moving the projector, has been introduced by Ansco, the photographic manufacturing division of General Aniline & Film Corporation.

The Ansco Memo Master Projector features a new 17mm-70mm focal length Zoom lens allowing the user to enlarge the picture on the screen four times its original size without moving the Projector one inch. A simple thermostat knob controls speeding up or slowing down continuously—in one smooth motion. A classic projection speed can be adjusted down to permit slow motion without flicker damage to film or loss of light level.

Reverse action setting on the master control knob permits review of special scenes. A powerful 6" cycle motor transmits a 4-foot row of film in one second.

The Memo Master has other great features for carefree, easy, accurate operation. High efficiency illumination system gives brilliant colorful pictures with edge to edge sharpness . . . 400-foot capacity for ½ hour uninterrupted show . . . constant frame positioning lever keeps picture in precise optical alignment . . . separate projection lamp switch provides quick cooling and increased lamp life and avoids annoying bright light during rewinding. The Memo Master is compact, handsomely designed and lightweight . . . less than 20 pounds in self-contained case with 400-foot reel.

In addition, Ansco will send a FREE roll of Movichrome 8 film to all new Memo Projector owners upon receipt of their registration cards. The new Ansco Memo Master Projector retails for less than $90.50.

BAUSCH & LOMB ANNOUNCES NEW ZOOM LENS SLIDE PROJECTOR

Bausch & Lomb has just announced that its new 500-watt projector the Balomatic 655 is now available with a zoom lens. This new lens permits up to 175% change in projection distance or picture size . . . effectively a whole battery of lenses in one. Instead of requiring several lenses priced at from $20 to $30 each, the zoom lens allows instant adjustment for small room, large room, balcony areas or large audiences. The focal length is continuously variable from 3¼" to 5½". The lens telescopes to fit the standard carrying case of the Balomatic 655, and the price of the complete projector with zoom lens is $146.5.

The zoom lens adds one more to the long list of desirable features of the fully automatic Balomatic 655. Among these are such advantages as instant slide editing without

tray removal, complete elimination of slides "popping" out of focus, one button forward or reverse operation at the projector or by remote control, split second slide change, non spill trays and many more. The Balomatic 655 is advertised as the most complete and best behaved projector on the market. With the standard 5" lens, the Balomatic 655 sells for $119.50. Complete information can be had by writing Bausch & Lomb Incorporated, Rochester 2, New York.

NEW ROLLEIFLEX WIDE ANGLE CAMERA

Closely following the introduction of the Tele-Rolleiflex with Zeiss Sonnar f4/135mm lens, Burleigh Brooks, Inc. is now showing the latest addition to the Rollei line the Rollei Wide Angle camera with the new Zeiss Distagon f4/55mm lens.

This new wide-angle camera is similar in design and operation to the Tele-Rollei, but will use the new series #4 accessories. An exposure meter can readily be installed if desired. The hood is instantly removable to allow use of the perfected Rollei prism finder.

The new Distagon lens is of 7 element air spaced construction, and at full aperture the lens covers a field of 71° with unusually fine resolution. The focusing range covers from infinity down to 24 inches.

With this new camera the professional and all other Rollei enthusiasts now have a dependable Rollei available for all their work, whether normal, wide-angle, or for tele requirements. List $399.50.

POLAROID INTRODUCES HIGH CONTRAST TRANSPARENCY FILM

A high-contrast transparency film that produces black and white slides in 10 (ten) seconds has been introduced for use with Polaroid Land Cameras.

Designated as Type 146 L Polaline Projection Film, the high-contrast material is ideal for copying charts, graphs, line and engineering drawings, book pages, newspaper text sheets and other tabular-type artwork where sharp black and white contrast with no middle gray tones is desired.

The Polaline Projection Film has a speed rating of 200 (ASA daylight equivalent). Each film roll produces eight 3¼ x 4¼ inch transparencies for use in Standard lantern slide projectors.

Suggested retail value is $3.49 per roll.

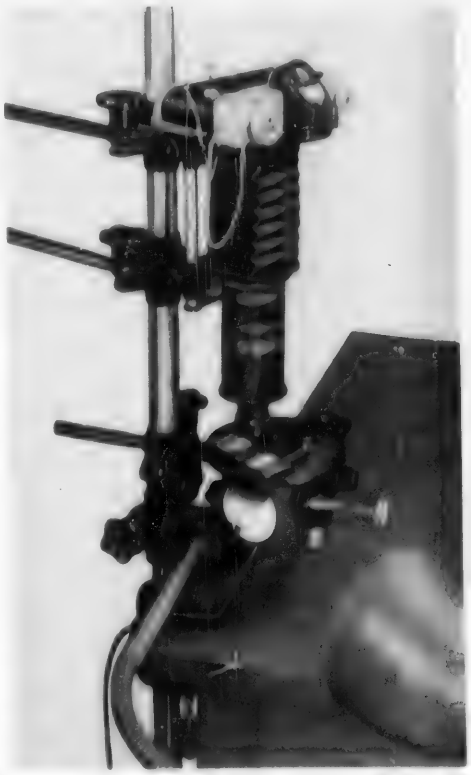
NEW EDNALITE SIZER GUIDE HAS LATEST LISTINGS

Brand new and cram-packed with the latest listings of FILTERS, ADAPTERS, SUNSHADES and SCREW-IN FILTERS for all types of cameras and lenses, the EDNALITE SIZER GUIDE is now available through your local Ednalite distributor.

The 24-page reference guide also includes a complete quick-reference FILTER and PORTRAIT LENS information and charts SECTION, plus important facts about the new EDNALITE INSTA FIT SYSTEM.

KALART ACQUIRES TSI

Technical Service, Inc., a leading manufacturer of special purpose projectors, was purchased by the Kalart Company, Inc., in a move to further expand its activities in the audio-visual field. It was announced that TSI officially joins the Kalart family on September 1, 1961. The company's manufacturing facilities and offices, now headquartered in Farmington, Michigan, will be moved to Kalart's home in Plainville, Connecticut.



ULTRA CLOSE-UP PHOTOGRAPHY WITH THE ALPA

The special Microlat focusable Lens with condenser, iris diaphragm, mirror, and transparent glass-plate permits the taking of extreme close-ups with transmitted light. Attachable to the ALPA Macrostat Close-up stand and used with the ALPA 35mm Single-lens Reflex camera equipped with Luminar 25mm f/3.5 special close-up lens (plus extension tubes and bellows), it permits picture-taking at reproduction ratios from 1:1 up to 10:1 magnification, bridging the gap between regular close-ups (infinity to 1:1) and Photomicrography (10:1 to 1500:1). Price: $119.90. Dist.: Karl Heitz Inc., 480 Lexington Avenue, New York 17, N.Y.

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*Deceased April 13, 1961

FELLOWSHIP PROCEDURE

Members may propose for Fellowship in the BPA other members whom they consider worthy of recognition. To be eligible for Fellowship a candidate must have been a member of the Association for five consecutive years and must possess one or more of the following qualifications:

Superior craftsmanship in still or motion picture photography of biological subjects.

Ability in photographic research in new methods or materials.

(These require submission of evidence.)

Meritorious contributions to biological photography overall through sustained organizational work.

Two sponsors are required. The sponsors should be well acquainted with the candidate's work and ready to furnish the Board with details of his experience and achievements. Those who wish to sponsor a member whom they believe to be eligible should request a Fellowship Application form from the Secretary of the Fellowship Committee: Mrs. Maria Ikenberg, University of Illinois, 904 W. Adams Street, Chicago 7, Illinois.

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